1988 NATIONAL BUREAU OF STANDARDS AUTHORIZATION

HEARING

BEFORE THE

SUBCOMMITTEE ON
SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

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*Ranking Republican Member.
**Resigned February 19, 1987 (H. Res. 89).
***Elected March 30, 1987 (H. Res. 133).
****Ex-Officio, voting member.

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1988 NATIONAL BUREAU OF STANDARDS AUTHORIZATION

TUESDAY, MARCH 3, 1987

House of Representatives,
Committee on Science, Space, and Technology,
Subcommittee on Science, Research and Technology,
Washington, DC.

The subcommittee met, pursuant to notice, at 9:40 a.m., in room 2318, Rayburn House Office Building, the Honorable Doug Walgren (chairman of the subcommittee) presiding.

Staff Present: David Goldston; Jim Turner; Carol Pompliano.

Mr. Walgren. I apologize for the delay this morning and appreciate your indulgence, but let us begin.

Standards are as basic to U.S. competitiveness in the world marketplace as the dollar is to international commerce. If our industry cannot make products with increasing precision, tied into central standards of measurement, we will lose more and more markets to overseas competitors who can.

The National Bureau of Standards as our national measurement laboratory is a unique entity in our fight to remain economically competitive and ahead of many in the world. NBS employees perform much of this country's measurement research and serve on over a thousand private sector standard setting committees.

The Bureau holds over a hundred conferences a year where it serves as the exchange place for ideas on how to improve measurement and quality in particular industries. And today, if we toured NBS we would find over 200 research associates from industry, and even more guest workers from academia working side by side with National Bureau of Standards employees.

It is not surprising that the Bureau receives uniform high praise from industry and academia. It's also not surprising that great concern is expressed about the budget treatment NBS has received prior to the FY 1988 budget request.

For several years now we have been presented with budgets that ask the National Bureau of Standards to give up a little more, to give up a few more employees, to absorb the cost of inflation, even though programs are clearly worthwhile.

The Bureau is asked to initiate new programs and given no room to do that. We have been deeply concerned, but have been limited in what we can do in the face of the active Administration lobbying against any increased assistance to the Bureau.

I am hopeful that the 1988 budget will mark a turning point for the National Bureau of Standards. For the first time since I have been chairing this subcommittee the Administration has recommended a modest increase of $16.6 million in its 1988 request for NBS.

While most of these funds go for inflationary increases, for environmental site work, for construction, and for implementation of the new federal employee retirement system, the Bureau is also permitted to begin very modestly a number of important programs which will be described by our witnesses today.

This request is an appropriate first step towards rebuilding the National Bureau of Standards. I hope it is the prelude to substantial increases in the years ahead, both for NBS programs which aid basic industry, and also for NBS's efforts to develop the capability to aid emerging high technology industries.

I think it only right to say a word about the Fire and Building Programs in the National Bureau of Standards. As many of you know, very reluctantly at the end of the last Congress, the leadership of our Authorizing Committees, both in the House and the Senate, agreed to reductions that totalled about a million dollars in the Bureau's Fire and Building Programs, and a comparable two and a half million dollar reduction in the budget for the Institute for Computer Sciences and Technology.

In return, the Office of Management and Budget agreed in writing that these programs would not be cut further by this Administration. We also agreed in exchange for that, that work would go forward on the Cold Neutron Facility, and start at a $6.5 million authorization level. The Cold Neutron Facility is one that the Administration has been the strong supporter of, and it is certainly widely recognized by Congress as being able to contribute very real progress in an extremely cost effective manner.

The Appropriations Committee went along with each of these decisions, except that they trimmed the budget for the Cold Neutron Facility by $2 million, leaving about a $4.5 million effort in that area in response to learning that the $2 million reduction would not affect the construction timetable, nor the size and the scope of the facility. We were very disappointed to say the least when we learned that the Fiscal '88 budget request once again contains real reductions for the Center for Fire Research and the Center for Building Technology.

These Centers, as well as the Cold Neutron Facility, are too important to be reduced further. And therefore, I for one, would expect to continue to honor our agreement of last October and to make sure that each of these three programs is funded at the agreed upon level for 1988.

[The prepared opening statement of Mr. Walgren follows:]

OPENING REMARKS
OF THE
HON. DOUG WALGREN
FOR THE
NATIONAL BUREAU OF STANDARDS AUTHORIZATION

MARCH 3, 1987

STANDARDS ARE AS BASIC TO U.S. COMPETITIVENESS IN THE WORLD MARKETPLACE AS THE DOLLAR IS TO INTERNATIONAL COMMERCE. IF U.S. INDUSTRY CANNOT MAKE PRODUCTS WITH INCREASING PRECISION, TIED INTO CENTRAL STANDARDS OF MEASUREMENT, WE WILL LOSE MORE AND MORE MARKETS TO OVERSEAS COMPETITORS WHO CAN.

THE NATIONAL BUREAU OF STANDARDS AS OUR NATIONAL MEASUREMENT LABORATORY OCCUPIES A UNIQUE NICHE IN OUR FIGHT TO REMAIN COMPETITIVE. NBS EMPLOYEES PERFORM MUCH OF THIS COUNTRY'S MEASUREMENT RESEARCH AND SERVE ON OVER A THOUSAND PRIVATE SECTOR STANDARD-SETTING COMMITTEES. THE BUREAU HOLDS OVER A HUNDRED CONFERENCES A YEAR, WHERE IT EXCHANGES IDEAS ON HOW TO IMPROVE MEASUREMENT AND QUALITY IN SPECIFIC INDUSTRIES. TODAY, IF WE TOURED NBS, WE WOULD FIND OVER 200 RESEARCH ASSOCIATES FROM INDUSTRY AND EVEN MORE GUEST WORKERS FROM ACADEMIA WORKING SIDE BY SIDE WITH NBS EMPLOYEES.

IT IS NOT SURPRISING THAT THE BUREAU RECEIVES UNIFORM HIGH PRAISE FROM INDUSTRY AND ACADEMIC LEADERS. IT ALSO IS NOT SURPRISING THAT GREAT CONCERN IS EXPRESSED ABOUT THE BUDGET TREATMENT NBS HAS received prior to the FY 1988 budget request.

For several years now we have been presented with budgets that ask the National Bureau of Standards to bleed a little more, to give up a few more employees, and to absorb the costs of inflation and of the badly needed new programs the Bureau is asked to initiate. We have been deeply concerned, but have been limited in what we can do in the face of active Administration lobbying against any increased assistance to the Bureau.

I am hopeful that the 1988 budget marks a turning point for the National Bureau of Standards. For the first time since I have been chairing this Subcommittee, the Administration has seen fit to provide a modest increase of $16.6 ~~$14~~ million in its 1988 NBS request. While most of these funds go for inflationary increases, for environmental site work, and for implementation of the new Federal employee retirement system, the Bureau is also permitted very modest beginnings for a number of important programs, which will be described by our witnesses today.

This request is an appropriate first step towards rebuilding the National Bureau of Standards. I hope it is the prelude to substantial boosts in 1989 and 1990, both for NBS's programs which aid basic industry and also for NBS efforts to develop the capability to aid emerging high technnology industries.

In closing, I would like to say just a word about the fire and

BUILDING PROGRAMS IN THE NATIONAL BUREAU OF STANDARDS. VERY RELUCTANTLY, AT THE END OF THE LAST CONGRESS, THE LEADERSHIP OF THE PERTINENT AUTHORIZING COMMITTEES, BOTH IN THE HOUSE AND THE SENATE, AGREED TO CUTS TOTALLING $1,000,000 IN NBS'S FIRE AND BUILDING PROGRAMS, AND TO A $2,500,000 REDUCTION IN THE BUDGET OF THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY. IN RETURN, THE OFFICE OF MANAGEMENT AND BUDGET AGREED IN WRITING THAT THESE IMPORTANT PROGRAMS WOULD NOT BE CUT FURTHER DURING THE REAGAN YEARS. WE ALSO AGREED TO PERMIT WORK ON THE COLD NEUTRON FACILITY TO BEGIN, AT A $6.5 MILLION DOLLAR AUTHORIZATION LEVEL. THE APPROPRIATIONS COMMITTEE WENT ALONG WITH EACH OF THESE DECISIONS, EXCEPT THAT THEY TRIMMED THE BUDGET FOR THE COLD NEUTRON FACILITY BY $2 MILLION, AFTER LEARNING THAT THE $2 MILLION REDUCTION WOULD AFFECT NEITHER THE CONSTRUCTION TIMETABLE NOR THE SIZE AND SCOPE OF THE FACILITY.

WE WERE SURPRISED AND DISHEARTENED WHEN WE LEARNED THAT THE FY 1988 BUDGET REQUEST, ONCE AGAIN, CONTAINS CUTS FOR THE CENTER FOR FIRE RESEARCH AND THE CENTER FOR BUILDING TECHNOLOGY. THESE CENTERS, AS WELL AS THE COLD NEUTRON FACILITY, ARE TOO IMPORTANT TO BE TORQUED FURTHER. THEREFORE, I, FOR ONE, EXPECT TO CONTINUE TO HONOR OUR AGREEMENT OF LAST OCTOBER AND TO WORK TO MAKE SURE THAT EACH OF THESE THREE PROGRAMS IS FUNDED AT THE AGREED-UPON LEVEL FOR FY 1988.

Mr. **Walgren.** Well, we'll leave the record open at this point for a statement by the Ranking Minority Member, Mr. Boehlert, who will be along shortly, and the Chair would recognize Mr. Price for any opening comments or thoughts he would like to raise.

Mr. **Price.** No comments.

Mr. **Walgren.** Thank you, Mr. Price.

And then, turn to our witness list this morning. Our first witness is Dr. Robert Pry who is a Consultant and the Chairman of the NBS Visiting Committee.

We have four panels this morning, and we're trying to wrestle with how we can get everybody in, and particularly when we're at fault for a late start. I certainly don't want to be limiting in any way. Your full statement will be made part of the record, and you can certainly feel free to raise and underscore those points for discussion that you find most striking and most interesting. And we would recognize you now to proceed, Dr. Pry.

STATEMENT OF DR. ROBERT H. PRY, CONSULTANT, AND CHAIRMAN, OF THE NBS VISITING COMMITTEE, GREAT FALLS, VA

Dr. **Pry.** I really appreciate the opportunity to speak, and I also appreciate the change in order to accommodate my unfortunate travel problem.

As you know, every good show has a warmup man. You might say, therefore, that I'm a warmup man for Ernie's pitch in a little while.

I'm honored to testify today at your hearing on the authorization for the National Bureau of Standards. The other members on that committee are Dr. Norman Ramsey, Harvard University, presently a research fellow at the University of Colorado, Mr. William D. Manly, formerly Senior Vice President of Cabot Corporation, Dr. Arden L. Bement, Vice President, Technical Resources, TRW, Incorporated, and Dr. John Bollinger, Dean of the College of Engineering of the University of Wisconsin.

The Visiting Committee was established, as you know, by the NBS Organization Act of 1901 to provide assistance and outside review to the Secretary of Commerce. I will offer comments from the perspective of four year service on this Visiting Committee.

In addition, I have the perspective gained over 35 years as a performer and manager of industrial research, a sector which is one of the primary user groups of research and services from the National Bureau of Standards. My last position was as Vice Chairman—Technology of Gould, Incorporated of Chicago. I also served as a Professor at MIT, as Vice President of R&D of Computer Engineering, and for 25 years as a manager of Research and a Scientist at General Electric Company.

In my statement today, I'd like to make five main points.

First, the technical programs of NBS are very effective in my view. The quality of its scientific work is first rate, and it is pursuing programs that are appropriate and important to the nation in relation to its current needs. This is not just my opinion, but that of the committee as well, and the National Academy Team that examines the Bureau's work in detail and reports the results to us.

Two, even though it appears that a sizable budget increase has been requested for NBS this year, a closer look shows that over 80 percent of this net increase covers higher cost for existing research programs. NBS total staff levels will not increase under this budget. In fact, they will decrease slightly.

Three, the financial resources appropriated to NBS appear small in relation to the industrial problems and opportunities it must respond to. The rapid pace of technology has grown even faster.

In addition, the industrial competitiveness issues affecting NBS users have deepened. One of the highest priority needs of this nation is to develop a much stronger supporting partnership between the business and government sectors, a relationship that will bring new vitality, through technology, to our ongoing core businesses, and bring new technology to new workers in our new businesses. Among all of the nation's laboratories, this has been and continues to be, a major theme and purpose of the National Bureau of Standards.

Four, I think it's very appropriate that the NBS continue to provide technical support to strategically important, but dispersed and fragmented industries, such as the construction and materials industries served by the NBS fire and building research activities.

These are perfect examples of industries for which government research support is both justified and vitally needed. In a real sense, NBS serves as the nation's technology laboratory for such non-defense industries. However, I am concerned that the desire of your subcommittee to increase funding for fire and building activities may possibly result in the dilution of funds from other essential NBS programs. I know that this committee will strive to make that not happen.

Number five, improvement of NBS research facilities is a priority need. I'm glad to see the start of construction of the national user facility for cold neutron research, even though it hiccuped at the start in terms of funding reduction. But regular laboratory facilities and scientific equipment of NBS also needs upgrading to support continuing leadership in emerging technologies and increased private sector access and use.

My focus on facilities is not meant to overlook the fact that having talented creative people is still the most critical element in the research laboratory like NBS. For this reason, the Visiting Committee is glad to see that the Post Doctoral program has been restored in the present budget; something that the Visiting Committee has urged over the last two years.

This is a very effective way to bring new ideas and bright young talented people into the laboratory from among the best in the nation.

My written statement elaborates on the above points.

In summary, I'd like to stress one point. In my view, NBS is doing excellent and relevant work. While everybody in the government talks about competitiveness, and the importance of technology and improving it, NBS is one of the few organizations that is making direct contributions and could help industry even more. And its role of providing technological infrastructure support is completely compatible with anybody's view about the role of the federal government. But how can we be serious about doing something to improve international trade, and help American firms regain their competitiveness if we allocate the relatively small amount of $138 million to utilize the capabilities of the National Bureau of Standards. After all, the nation spends about $200 billion, a thousand times, more than a thousand times more per year for measurement related activities alone. Based upon the scope of the problem, the budget of NBS is a precious drop, but none the less a drop in the bucket.

If we're serious about taking action, as we should be, now is the time to assign additional tasks to NBS and provide the resources to do them.

From my vantage point, we should be committed to at least doubling the budget level, in real terms, of the National Bureau of Standards in the next five years.

In Title II of the Trade, Employment, and Productivity Act of 1987, the President last month asked Congress to pass legislation that would double the budget of the National Science Foundation during a five year period. This is a good move, and urgently needed. But what national economic purpose is served in the development of a leadership position in science, if at least equal emphasis is not placed into packaging that science into methods, tools, standards, and technological ideas that all industry, small as well as large, can use to rejuvenate our capital formation at home and reassert our business leadership abroad.

There are timing limitations to many incremental opportunities such as easing our federal deficit, and improving our export capability. Right now, R&D budgets of many organizations in the commercial world are shrinking, from petroleum to steel, and even to commercial and industrial electronics.

If we're serious, the federal government must help support the conversion and packaging of U.S. science into generic technology that industry can use in developing its products and services. I would like to see this Congress take a firm initiative in these directions.

Thank you for this opportunity to speak to the subcommittee. Mr. Chairman, I will be glad to respond to your questions.

[The prepared statement of Dr. Pry follows:]

STATEMENT OF

DR. ROBERT H. PRY

CHAIRMAN, NATIONAL BUREAU OF STANDARDS

VISITING COMMITTEE

TO THE SUBCOMMITTEE ON

SCIENCE, RESEARCH, AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

MARCH 3, 1987

I am honored to testify today at your hearing on the authorization of the National Bureau of Standards. I speak as the current Chairman of the Visiting Committee of NBS. The other members are Dr. Norman F. Ramsey, Harvard University, presently a research fellow at the University of Colorado, Mr. William D. Manly, formerly Senior Vice President of Cabot Corporation, Dr. Arden L. Bement, Vice President, Technical Resources, TRW Inc., and Dr. John G. Bollinger, Dean, College of Engineering, University of Wisconsin. The Visiting Committee was established by the NBS Organic Act of 1901 to provide assistance and outside review to the Secretary of Commerce. I will offer comments from the perspective of four years service on this Visiting Committee. In addition, I have the perspective gained from over 35 years as a performer and manager of industrial research, a sector which is one of the primary user groups of research and services from NBS. My last position was as Vice Chairman-Technology, of Gould, Inc. I also served as a Professor at MIT, as Vice President of R&D of computer engineering and for 25 years as manager of research and a scientist at General Electric Company.

Dr. Ambler will shortly provide you details of FY 88 budget requests. Without covering that same ground, I want to state that the Visiting Committee strongly supports the need for and the technical thrusts of the initiatives in process control and quality assurance, high-performance composites, bioprocess engineering, lightwave measurement technology, and computerized reference databases.

In my statement today, I want to make five main points.

1. The technical programs of NBS are going very well in my view. The quality of its scientific work is first rate, and it is pursuing programs that are appropriate and important to the nation in relation to its current needs.

2. Even though it appears that a sizable budget increase has been requested for NBS this year, a closer look shows that over 80% of this net increase covers higher costs for existing research programs. NBS total staff levels would not increase under this budget.

3. The financial resources appropriated to NBS appear small in relation to the industrial problems and opportunities it must respond to. The rapid pace of technology has grown even faster. In addition, the industrial competitiveness issues affecting NBS users have deepened. One of the highest priority needs of this nation is to develop a much stronger supporting partnership between the business and government sectors, a relationship that will bring new vitality, through technology, to our ongoing core businesses and bring new technology to new workers in our new businesses. Among all of the nation's laboratories, this has been, and continues to be, a major theme and purpose of NBS.

4. I think it is very appropriate that NBS continue to provide technical support to strategically important but dispersed and fragmented industries, such as the construction and materials industries served by NBS fire and building research activities. These are perfect examples of industries for which government research support is both justified and vitally needed. In a real sense, NBS serves as the nation's technology laboratory for such non-defense industries. However, I am concerned that the desire of your Subcommittee to increase funding for fire and building activities may result in the dilution of funds from the other essential NBS programs.

5. Improvement of NBS research facilities is a priority need. I am glad to see the start of construction of the national user facility for cold neutron research, but regular laboratory facilities and scientific equipment of NBS need upgrading to support continuing leadership in emerging technologies and increased private sector access and use.

Let me elaborate on these points.

From my perspective as an industrial manager, I believe NBS is pursuing the right technical programs. This is important because industry depends on the accuracy, objectivity, and excellence of the scientific and engineering work the Bureau does. It is research that many individual firms or industries are not able to do, and in measurements and standards activities none can do. I can affirm that duplicative research is not an issue. Since the sixteen outside assessment panels organized by the National Research Council of the National Academys of Sciences and Engineering report to our Visiting Committee, I can confirm that their annual evaluations of individual technical programs of NBS judge their quality to be very high.

NBS is properly forward thinking, as it should be. It has consciously focussed on emerging technologies that industry will soon be applying, such as ceramics, composites, optical communications, biotechnology, and advanced microelectronics.

They have smaller than needed, but very productive programs underway in each of these fields.

Dr. Ambler and several others have pointed out to this Subcommittee before that the work of the Bureau is ever more important at this point in our history because of the national need to reassert leadership in international competitiveness. Since competitiveness is on almost everybody's lips in Congress, the Administration and the public, I only will remind you that measurement is the very foundation for assuring quality and cost-competitiveness of this country's products and services. We should be increasing the amount and consequently the effectiveness of this assistance which the Federal government provides to industry and academia through NBS.

Which brings me to my second and third points about resources. When I compare the almost constant level of technical staff resources NBS has been able to apply over the last ten years to the large and growing national and international issues faced by American firms, both large and small, I become very concerned. Technology is moving even faster than ever here at home and often even faster in other nations, and the markets for products are truly worldwide. While I was gratified that for the first time in several years an increase is being requested for NBS in the FY 88 budget, only about one-fifth of the net increase has the effect of raising the level of NBS research activity. The other

80% covers increased costs for existing research programs, and construction of physical facilities. Total staff levels will actually decline slightly. Added resources several times the size of this increase are certainly justified in relation to the nation's needs. American industry and universities are increasing their research, both basic and applied. The Bureau's contributions to the technological infrastructure in the form of measurements, testing methods, data, and standards must increase commensurately if rapid commercial benefits are to be realized for American firms.

My fourth point relates to the continuing discussion about fire and building research. I feel one of the strongest arguments for certain NBS programs is the need to provide technical support to dispersed or fragmented industries. Because of the continuing media coverage of large corporations, we must continue to remind ourselves that more than one-half of this country's gross manufacturing product is produced by firms employing less than 500 employees. Such industries are not in a position to conduct the research needed to advance the industry and stay ahead of foreign competition. In dispersed industries, no one firm or even a consortium of firms can afford to make significant investments, partly because they cannot be sure of fully capturing the benefits of it. Economists have always agreed that this situation justifies an active government role.

A prime example of such industries is those served by NBS programs in fire and building construction, for which NBS has provided technical support for decades. The construction industry in the U.S. is very large, but dispersed; there is no equivalent capability to NBS to do research in such areas as building systems, concrete strength/deterioration, or building codes. New opportunities in these areas are increasing rapidly as new materials, computer-aided design and construction, manufacturing methods, and measurement methods are developed. Fire prevention and control has the added argument of being a governmental or public function; profit seeking firms do not have the incentive to fund basic research or even applied research in this area, and new approaches to these issues are arising through new science in laser measurements, sensor systems, and materials. Furthermore, the investigation of causes of fire and natural catastrophes by NBS would not be feasible except for the research supported by these programs.

My last point deals with the necessity to upgrade laboratory facilities. In recent years NBS has increased significantly the amount of cooperative research done at NBS by industrial firms, professional societies, and Federal agencies. This approach has the advantage of completing more needed research of mutual interest, and involving user organizations directly in the work so as to improve the technology transfer process. For some laboratories, such as the NBS research reactor, organizing them as national user facilities open to all firms is feasible. The new cold neutron facility will be structured that way. However, the bulk of NBS laboratories and equipment set-ups have evolved in the course of research done and supervised by NBS employees. If substantial increases in private sector use is to occur, significant modifications will be needed. NBS should be encouraged to upgrade their laboratory facilities so that industrial firms can have improved access and use of the specialized capabilities of NBS.

My focus on facilities is not meant to overlook the fact that having talented, creative people is still the most critical element at a research laboratory like NBS. For this reason, The Visiting Committee is glad to see the post-doctoral program restored at NBS. This is a very effective way to bring new ideas and people into the laboratory from among the best in the nation.

In summary, I want to stress one point. In my view, NBS is doing excellent and relevant work. While everybody in the government talks about competitiveness and the importance of technology in improving it, NBS is one of the few that is making direct contributions, and could help industry even more. And its role of providing technological infrastructure support is completely compatible with anybody's concerns about the role of the Federal government. But how can we be serious about doing something to improve international trade and help American firms regain their competitiveness if we only allocate the relatively small amount of $138 million to utilize the capabilities of the National Bureau of Standards. After all, the nation spends about $200 billion per year for measurement-related activities. Based upon the scope of the problem, the budget of NBS is a drop in the bucket.

If we are serious about taking action, as we should be, now is the time to assign additional tasks to NBS and provide the resources to do them. From my vantage point, we should be committed to doubling the budget level of the National Bureau of Standards in the next five years. In Title II of the Trade, Employment, and Productivity Act of 1987, the President last month asked Congress to pass legislation that would double the budget of the National Science Foundation during a five-year period. This is a good move. But what national economic purpose is served in the development of a leadership position in science, if it is not packaged into methods, tools, standards and technological ideas that all industry, small as well as large, can use to rejuvenate our capital formation at home and reassert our business leadership abroad. There are timing limitations to many incremental opportunities such as easing our Federal deficit and improving our export capabilities. R&D budgets of many organizations are shrinking. If we are serious, the Federal government must help support the conversion or packaging of U.S. science into generic technology that industry can use in developing its products and services. I would like to see Congress take the initiative in these directions.

Thank you for this opportunity to speak to the Subcommittee. I will be glad to respond to your questions.

Mr. **Walgren**. Thank you very much, Dr. Pry. We appreciate those perspectives, and they really should be strong encouragement to this committee to think freshly about the NBS and its contribution.

As you know, one of the things we've always struggled with is the name of NBS. It's just not translatable to a person in the street or other Members of Congress who are not focused on it, and who are focused on all kinds of other issues than technology or science. And it seems so hard to get their attention.

How do you solve that problem? If you were talking to a member of Congress who didn't know the NBS from his left foot, what would you tell him to really get his or her attention and understanding of the importance of NBS' role?

Dr. **Pry**. I think two things, Mr. Chairman. First of all, as you know, the National Bureau of Standards was indeed set up originally to provide methods and standards for the commercial industries of the United States. It has done that job well. It is still a core function of the Bureau. But the standards of tomorrow are the research frontiers of today.

So that in order, even though one maintained a fairly narrow view of the Bureau's mission, it requires that over a broad front, from biotechnology to electronics to software, that it be knowledgeable at the forefront of the science in order that it understands its mission in the future.

Over and above that, it is the only laboratory, in what I call the defenseless part of government, that has as a charge, a direct charge, assisting the commercial and industrial enterprises of the United States non-defense.

So that it's mission has grown over the years from that of being a setter of standards and measurements, into also recognizing its contribution in the transfer of technology, from the university campus, from wherever it comes in the forefront of science, to packages, if you like, to generic technologies that are useful to industry.

While I was active in industrial research in Fortune 500 companies, many of my colleagues, both then and some of them present in the room today, would say, but industry does not need such a research function in government.

It is necessary to remind them that they are a very small segment, the Fortune 500, in the gross national and gross manufactured product of the United States. To remind them that half of the gross manufactured product of the United States is created by companies of less than 500 employees. Where indeed are they going to get their help with universities that have been diverted, if you like, to a large amount of research underlying the defense establishment of the United States.

That's a long answer to a very short and succinct question, Mr. Chairman.

Mr. **Walgren**. Well, it's an important answer, and one that we appreciate for the record. I can't help but remember that one of the most involved people in the area of manufacturing science is the president of Carnegie-Mellon University, Richard Cyert. He wrote an article in which he talked about, and this was looking at 1984 and things really haven't changed since then, the total manufacturing or the total expenditures in research and automative manufacturing in our country was something like, on the federal level, $80 million, of which $60 million was put in by the military. And the NBS's contribution was almost nil, something in the range of 10 million or below. And it just seems so clear that our effort in this area is, as you say, a drop in the bucket. And we have to ask ourselves, are we going to be satisfied with our role in this process if we never argued for much more than a drop in the bucket.

Dr. **Pry**. Mr. Chairman, if I may respond to that, just very briefly. I did say, a precious drop. And I said a precious drop for a very good reason. The National Bureau of Standards has always puzzled me. It is a laboratory, as you know, that operates within the civil service guidelines, unlike GOCO laboratories, for example, under the Department of Energy. And yet, it is probably one of the most excellent laboratories consistently over the years of any of our federal laboratories.

Now, the word about manufacturing. Yes, indeed, the Bureau's part in manufacturing research is very small. I would simply note, however, as a single example, that the underlying work that led to the so-called MAP research at General Motors, MacDaC and Boeing for putting all the manufacturing systems together; a protocol and interface standards started right here at the Bureau of Standards. And they picked up on that generic catalytic work, and have carried on with that idea in this very large program in commercial industry.

So, it may be small, but it is precious.

Mr. **Walgren**. Well, we want to do everything we can, not only to maintain the contribution it has made thus far, but to really break out of some of the limitations that we've had on our thinking as to what NBS could mean for our side.

Let me recognize the Ranking Minority Member, Mr. Boehlert.

Mr. **Boehlert**. Thank you, Mr. Chairman.

Dr. Pry, what initiatives do you feel were left out of this whole thing, if you could redo the budget and provide some more funds, where would you provide them?

Dr. **Pry**. Congressman Boehlert, one of the difficulties in the budgeting process happens, not just in government, it happens in industry as well. As you continue to shave the salami, if you like, you don't cut programs, you starve them to death.

If I look at the major initiatives that NBS is trying to get started in things like biotechnology, a vast field of telecommunications, where we're just not even touching the surface.

Manufacturing technology, as the Chairman pointed out, we are still fairly small. Very good, but very small in that area. And quite frankly, some of the core traditional areas of the National Bureau of Standards are really in trouble. If I look at the work in time standards, in voltage current standards, those things that many people in the civilian sector say, for heaven sakes, you've been measuring these things since 1900, aren't you ever going to quit. The fact of the matter is, those standards and measurements are so much needed, even by our military sector now and our space sector, in the work that they are doing off of the face of the earth.

So, in a measure of the problem with respect to these core areas is the aging of the staff in those areas. There is just not enough money to bring in new people, to not only carry on but put that work on an even more forward basis.

So, in answer to your question, I think it is no one thing that has been left out. I think we are having a problem over the years of continuing malnutrition, if you like, with a Bureau that is doing its best to be excellent in its core areas, while starting some new initiatives that it thinks are very important.

Mr. BOEHLERT. Dr. Pry, I want to assure you that none of us up here want to put anyone on a starvation diet. And as I look at page three of your testimony, one point in particular that caught my attention. Your expressed concern that the desire of this subcommittee to increase funding for fire and building activities may result in the dilution of funds from the other essential NBS programs. We are, at least speaking for me, determined with respect to the fire and building activities, but not to substitute, to supplement. I don't want to cut back.

Dr. PRY. No, I brought that out simply because, as the saying goes, it has happened.

Mr. BOEHLERT. Sure, I understand.

Are you encouraged by what we did last year, and the opportunity that NBS has presented to do a China Lake study type of venture with its professional personnel?

Dr. PRY. Yes, indeed. Yes, indeed.

Mr. BOEHLERT. Would you care to comment anymore on that?

Dr. PRY. Not at this time, no, sir.

Mr. BOEHLERT. Okay. Do you think industry makes adequate use of the Bureau's research and materials?

Dr. PRY. No.

Mr. BOEHLERT. What can we do to promote—

Dr. PRY. One of the great problems that the United States has, and I mentioned it a little earlier, the great base of our industry and business activity is in relatively small firms. Those small firms still have great interface problems with technological and technical organizations; and they still need a great deal of help.

It's easy enough for General Electric or Gould or General Motors to interface with another laboratory, because they have image people in their own labs themselves. It's very difficult for a young firm and a small firm to do that.

First of all, they have the problem, if I could spare he might fire him, so they can't have people coming here that much. And secondly, it's sort of a different language.

I think some additional outreach areas, outreach programs, to try to plug into the smaller firm, as is done quite frankly in the building and fire research area. That's a perfect case of dispersed and fragmented industry, that the federal government should have support activities for it. But there are many others. There are wood products, there are textiles, you know. You can name it, shoes.

There's some activities the Bureau is doing in manufacturing research that could be very valuable to those kinds of industries.

And so, there's an area, I think, in making it more effective, it could be very effective.

Mr. BOEHLERT. Well, do you think they could do it with NBS within the constraints of the existing budget or are you arguing for more——

Dr. PRY. Not at all. Not at all. That has to be a new activity. Not at all.

Mr. BOEHLERT. Okay. Thank you very much, Mr. Chairman.

Mr. WALGREN. Thank you, Mr. Boehlert.

Mr. Price?

Mr. PRICE. Back for a moment to the comment in your statement about the importance of not increasing funding for fire and building activities at the expense of other areas.

As you know, the Fiscal Year 1988 budget does propose a decrease of the $3.8 million through combining the NBS Centers for fire research and building technology into a Center for fire and building safety research. I wonder if you could comment on that proposed decrease.

Dr. PRY. I think it's a mistake quite frankly. I really do. I have appeared before this committee, even before I was a member of the Visiting Committee and had no direct interest in either the National Bureau of Standards or in building and fire research, to plead for restoration some five or six years ago, in the budget for fire and building research. Largely, because of my long-term interest in the health and vitality of the infrastructure of the United States. Fire and building being clearly, building materials being clearly that.

If there is ever a time when it is important to revisit that issue, it is now. All you need to do, if you ever get up to Brook Haven National Laboratory, for example, is to look at the new house that they have from Sweden on their campus, which is an incredibly energy efficient house, with new materials partly manufactured—manufactured and shipped in parts over here. A beautiful place.

We are being—the next large area, in my view, if you look at what's going on in Japan in manufacturing houses as well, the next large attack on the United States, maybe not the next, but in the fairly new future, is going to be an attack on our building industries. We already see it with respect to construction companies in Europe building—bidding on and building large complexes in the United States. We're going to see that come down to our housing industry. I think there's just no question about that.

The fire research, of course, is another area where people's safety I think cannot be compromised. There are a lot of new tools that can be used to examine the whole issue of fire research. The study of early combustion in combinations of plastic materials and natural materials, using lasers, spectroscopy, for example, as a way of studying the flame. New sensors that have come along. A vast array of new materials that are now coming on the market and being developed, where one needs to understand the issues with respect to fire.

Just because—I mean, people make the mistake of thinking that things like building and fire, they're old issues. No, no, they're continuing needs. They're continuing needs to which new technology and new standards, not only can be applied, must be applied, if we're to maintain and grow our own infrastructure and maintain competitiveness abroad.

Dr. PRICE. Although mandated in last years NBS authorization bill, the post doctoral program is not being fully funded. As Chairman of the Visiting Committee would you comment on the effectiveness of the post doctoral program at NBS for contracting and retaining first class scientific talent?

Dr. PRY. Let me say this, I, you know, I have a history going back to the Bureau many, many years. When I got out of graduate school I sought a position at the Bureau around 1950, 1951. At that time, it was an absolutely excellent laboratory. One of the reasons it's excellent is that it has utilized in the past bringing in young talent, fresh Ph.D.s on a temporary basis, that's normal in academia to call them post-docs. Now, that is to say, appointments are a year, year and a half, two years; where the young man has not made a permanent commitment to be in a government laboratory, which has a certain stigma among the more aggressive people on campus.

To expose them to the kind of excellence that exists in the Bureau, let's face it, it's a way of getting hooked. And most of the very excellent staff in the Bureau come in on that mode. That once they are here, and it's an opportunity to get the best talent in the country, once they are here they want to stay.

So, I cannot be more positive and more definitive on the need to not only maintain, but to grow that post-doc program.

Mr. PRICE. Thank you, Dr. Pry. Thank you, Mr. Chairman.

Mr. WALGREN. Thank you, Mr. Price.

Ms. Schneider.

Miss. SCHNEIDER. Thank you.

I was interested in getting back to the discussion about the research that is being done. And I think that your reference to competitiveness and our capability to compete in a number of different areas I believe is being hampered by our failure to disseminate that information more rapidly; and I'd like to know what emphasis your Bureau is placing on information dissemination, and if you have a goal setting and strategy following effort along those lines?

Dr. PRY. Yes, let me address that, because I think there are some things that are going on right now that may hamper what I consider the Bureau's excellent ability to do that transfer.

I, perhaps, hold a more novel view than most, and that is, that communication is never transmitted by the written word. Fundamentally, these kind of documents are archival in nature.

Communication is a body contact sport, as is technology transfer. If you don't rub the bodies together you really don't get it.

Let me make a very simple example, I think I've made it to this committee before in past years. Imagine yourself in church on Sunday or in a Synagogue on Saturday. There is a man standing there who is saying things that intellectually you may well believe. You can understand it up here. You may even subscribe to it up here. But it never quite gets down here. And as you walk out of that lecture hall, if you like, you go about your way and do what you've always been doing. That—in other words, the transfer has really not taken place. If I think about the number of people in industry that say, oh, yes, I understand that science; I understand what the opportunity might be. But I'm not going to devote my time to it. The only way you get that commitment is to get people to come on board, live with you during the development of it and take that away, if you like, evangelistically, with a real commitment to proceed.

The Bureau of Standards has for many years maintained an in-house program with industry, of visiting people on campus, both from academia and from industry, visiting people on campus that bring in information from the industrial need standpoint, and take out information from a science standpoint. You know, that's the best way to do the transfer. That is being jeopardized right now, in my view, by the suggestion that people who come into the Bureau be charged for the privilege. And I think it will do a lot of negative things for the Bureau.

Miss SCHNEIDER. What percentage of those people that do come in represent what we consider to be small industry as opposed to the GMs and the ATS?

Dr. PRY. As I mentioned a little earlier, I think before you came in, a much smaller number than I would like to see.

Miss SCHNEIDER. And what—is there any strategy that you have in addressing that?

Dr. PRY. Yes. But the Bureau at the moment does it. It would take a very large—it would take a significant increase in a Bureau program in order to do that, because as I say, there—unlike the Fortune 500 companies that have overlapped with the work of the Bureau, most small companies have a great underlap. That is to say, most small companies are working with today's and yesterday's technology, using vendor products and repackaging into their own goods, using vendor machinery off the shelf without adding anything to it to, to put it into their plants.

If I look, for example, at the textile industry, which I did when I lived and came down to Virginia and worked there for about a year in a novel organization, they used almost exclusively machinery from Italy and Germany. How can you expect them to compete in manufacturing when their machinery is Italian and German, who are their major competitors, and the prices of their labor are at least twice as high in this country. The only way they can do it is to adapt modern computer manufacturing systems technology from the United States, which we know how to do so well. But there's nobody in those places who knows anything about it.

So, we have to reach much further with specialized staff that are commissioned to go out and understand the issues, to bring the people in, a whole series of seminars, visiting programs, what everyone can do, to get the real backbone of our industry up to speed.

Miss. SCHNEIDER. If I were a chairman of the Investigations and Oversight Committee I would request that you prepare such a game plan, because it seems to me to be one of the most critical underpinnings of our failure to be able to transfer this information. And you say, whether you bring them in seminars or, you know, other forms of body contact, that's terrific. I think that's a policy agreement that we all share. But how you do it is really the key. And I think that it would be helpful if you had a game plan as to specifically how you can reach a larger audience in order to make us more competitive.

Dr. PRY. Congresswoman Schneider, you struck a cord, I happen to be an executive and technical consultant, I'd be glad to take that on.

Miss. SCHNEIDER. Terrific. Well, I'm sure the Chairman would be thrilled to receive that information, also.

I have two other questions I'd like to quickly get in. You mentioned your interest in telecommunications, biotechnology, the potential for doing the whole broad spectrum of additional work in these other areas.

It has been said, and I think that some of the witnesses later this morning are going to make the comment that they really question, to what degree the Bureau is really focusing on their original intent, their mission; and perhaps, they're getting off the course in terms of what you are to accomplish.

One of the frustrations this committee sees very often is the amount of research that is being done piecemeal by the Environmental Protection Agency, by NOAA, by this agency, that agency, and the right hand doesn't know what the left hand is doing, and yet, our taxpayers are expending numerous dollars for this purpose. And yet, those researchers that are involved in those various agencies feel very frustrated because they do not have enough money. And here it seems to me the simple management solution is to consolidate and cooperate in that research.

Now, the research that you mentioned, like biotechnology, obviously is being done by a number of different areas, number of different agencies, rather.

What would your agency bring to biotechnology research, for example, that other agencies would not?

Dr. PRY. I think I didn't say what I meant to awhile ago when I said—and let me just repeat it, and then expand upon it a little bit—that biotechnology, telecommunications, manufacturing research, and materials research, advanced materials research, are an absolute necessity, because those advanced technologies today lead to and demand methods and standards tomorrow.

There is no way that the National Bureau of Standards can ignore those fields, and you can't just jump in after and develop standards and methods.

Miss SCHNEIDER. But isn't some of that work already being done by some of those agencies like the Environmental Protection Agency that is involved in, you know, some degree of research, but also regulatory proposals?

Dr. PRY. Not standards research, no.

Miss SCHNEIDER. The National Science Foundation isn't?

Dr. PRY. Not standards research.

Miss SCHNEIDER. Okay.

Dr. PRY. The Bureau is the rockbed and the core of our development of standards and methods for the commerce of the United States.

Miss SCHNEIDER. What kind of standards would you bet setting for biotechnology?

Dr. PRY. Oh, there are a whole variety with respect to the categorization of specific materials, the evaluation and setting of kinds of test methods, the preparation of specialized materials to provide standards for those methods and for methods developed by others.

I'm just running through the retinue, if you like, of what the Bureau of Standards does for virtually every industry in the United States.

Miss SCHNEIDER. And my final question has to do with what kind of game plan or strategy, once again, that you might have in order to increase the investment on the part of industry, the contributions that industry might make?

Dr. **Pry**. Let me say again, something that's happening in the United States that worries me a great deal, both from the standpoint of government and from the standpoint of private enterprise.

I mentioned earlier that in the petroleum field, in the area of steel, and indeed in the area of electronics, industrial R&D is decreasing. The world leaders, like Exxon, ARCO, are essentially getting out of exploratory research—I mean, oil exploration research.

Now it's something the United States has done for many years, and unfortunately the Government is beginning to do the same thing, and that is, when you get in trouble financially, you essentially go around and shoot everybody—that is to say, you cut costs and forget the old saw that it takes money to make money.

Mr. **Walgren**. And your profits go up.

Dr. **Pry**. Very short term, very short term. It's called "selling the store." And in ten years, you won't have any, and you'll be assumed by someone else, who has perhaps been a little smarter, maybe a Japanese company that's had a slightly longer-range vision than you have.

Government is beginning to do the same thing.

Mr. **Walgren**. So we would then be assumed by a Japanese country instead of companies.

Dr. **Pry**. Perhaps, perhaps. But what we are doing, I think—let me try to put it in the same simple terms; I know it's very dangerous to talk about the Government in industrial analogies—but nonetheless, if I look at our trade deficit, which in part is causing some of our national deficit problems, our way of solving that is to cut government costs.

Now aren't we doing just exactly what we criticize industry for doing?

We are not trying to become more competitive by helping the infrastructure of the United States to develop internal capital and regain world leadership. We're trying to cut back in order to save ourselves in the short term, not recognizing is that what's really needed are longer-term investments, investments in capital growth of the United States, so that we can assume the international leadership we deserve.

I say we're doing the same internal—the euphemism in industry these days is "restructuring," as you know. Restructuring simply means you shoot all the executives and stop R&D. It seems to me that in many ways we are doing that in our governmental administration as well, as a short-term solution.

Miss **Schneider**. Well, you had mentioned earlier about the trade deficit being part of our national deficit problem, and I think that it's quite clear that those cuts that are taking place in this area are not going to reduce the deficit, but rather those cuts and reductions in research are being shifted into other priorities, more specifically the Defense Department.

Dr. **Pry**. That's correct.

Miss **Schneider**. And the chairman of this committee is sending a letter to the Budget Committee, which I am signing, indicating very clearly that there has to be a reorienting of our priorities as a government, because, as you are pointing out, with the industrial analogy and how we're making the same foolish mistake of eating our seed corn, in essence, we don't hear that message coming from the outside.

So I'm just full of recommendations and job descriptions for you, but it would be delightful——

[Laughter.]

Miss **Schneider**. It would be delightful, if you could write an op ed piece or something to get that information out, because from your perspective, I think it is particularly critical, and I think it is a perspective that is not well-known in the industrial sector.

Dr. **Pry**. It's very critical.

Miss **Schneider**. And it's now known by enough people.

Dr. **Pry**. It's very critical. Let me just make one additional point.

Being a professor, I can't—or an old professor, if you like, both old and for a short time a professor—my lectures tend to go in 50-minute stretches, and I know you can't stand that, so I'll just end on a very simple point.

Miss **Schneider**. That's all right. Members of Congress are not exactly known for being short on hot air. [Laughter.]

Dr. **Pry**. And that is the following: That what bothers me so much about our priorities right now is not so much where we spend our money. You know, we can spend all the money we can print. That, in my view, is not the issue.

The issue fundamentally is the precious resource that we have, which in the short-term is a zero-sum game, and that's the heads that we have, the intelligence, the creativity, the brightest minds of this country. And if we choose to put all those brightest minds on issues that are not addressing our strategic national economic goals, but rather in other fields, there aren't enough left in the short term to address those issues that we've been talking about this morning, and that's what gives me great concern.

Miss **Schneider**. Yes. The fact that the United States graduates only one-fifth as many engineers as the Soviet Union does certainly addresses this whole question of human resources, which we are not addressing.

Dr. **Pry**. Not only that, but when you look at where we put our engineers, compared to Japan and Germany, you recognize that we're taking a smaller number and putting them in a basket that cannot, in the first order, solve our national and international economic issues.

Miss **Schneider**. I have no further questions, Mr. Chairman.

Thank you, Doctor Pry.

Mr. **Walgren**. Thank you, Ms. Schneider.

You really are right on some of the most important perspectives, I think, that we could possibly think about.

I am believing that this committee, as an authorizing committee—and if you think about what the word "authorizing" really means—our responsibility is to give the authority for other parts of the governing system to do what is in the best national interest. And if we perceive that this effort is a drop in the bucket and therefore not even approaching the measures in terms of size that is in the national interest, then it is the responsibility of an authorizing committee to give authority for the rest of the system to live up to the national interest.

And you mentioned that you would hope to see the National Bureau of Standards doubled over five years in real terms. If you were to equate the Bureau of Standards with the contributions the National Science Foundation makes, and I think that most people who have thought about this believe that they are equal in their contribution, in terms of the importance of their contribution, you would then want the Bureau of Standards to have the same kind of growth that the National Science Foundation had, and certainly the measuring point should be before we got into all this self-defeating decimation of the last number of years.

And so I remember the chairman of the full committee who has retired, Don Fuqua, talking in his chairman's report about science education, saying that we really have to be thinking about the unthinkable.

Well, if you were to take that same measure, you find that NBS has not grown at all since 1980. In our authorization in 1981, we authorized $125 million, and it is presently not even reaching that in expenditures in 1987, $122 million, but if you were to apply the growth that the NSF has experienced during that same period of time and then double it, as we all recognize is right, and the Administration certainly recognizes for NSF and will soon recognize at some point for efforts like NBS, you would be talking not of doubling a base of 122, but you would be doubling a base of $190 million.

And so perhaps our real goal should be something in the range of $400 million over the next five years, as opposed to what would program out at somewhere in the $200-plus million range.

I say that not to contradict the idea that dollars aren't what we're—you know, that's not our purpose; our purpose is to drive the attention of the available quality or skills of the society.

Dr. PRY. Let me just say one word about that. It is easier, of course, to raise the NSF budget than it is to raise the budget of the Bureau in practical terms.

Mr. WALGREN. Why is that?

Dr. PRY. Because the NSF is a contracting shop, if you like. I mean, it contracts work in the universities where the talent already exists, working off of other kinds of funding, either state funding or whatever, so that you can ramp up much faster in that case than you can for an internal organization.

However—incidentally, when you stop smoking that, I'd like to take a couple of puffs off of it—I am a visionary, but you pass me in your arguments, which are very sound.

In the Bureau's case, it is also, because of where they sit right now, easier than it would normally be to ramp their budget more rapidly than I think, in a closed organization, you normally—a scientific organization, you think if it grows more than 25 percent per year, it's probably wasting some money in just getting going, the organizational issues.

In the Bureau's case, that isn't true, because as you know, one of the ways that they have helped to solve the problem of shrinking real-term budgets has been to increase their contracting from other agencies. Part of that, you know, if I really stared at it, I'd say, "Maybe it's a little diversionary. Maybe it could be much better focused and have a lot better impact on the United States, if, in fact, its own funds were increased and displaced some of those." Not entire, because you need that connection to the other agencies and the outside.

But I think it's gotten now—it's about 50-50. I think it's gotten a little bit more than it ought to be for a government organization of this type.

So I would agree with you. One, it should be done. Two, the people are in place, and the organization is in place to be able to do it, and counter the argument that you can't grow a research organization more than 20, 25 percent per year without waste.

Mr. WALGREN. Well, thank you very much on behalf of the committee, Dr. Pry. We certainly appreciate your perspectives and consider you a resource to use with appreciation for the past and anticipation of the future.

Dr. PRY. Thank you very much.

Mr. WALGREN. Thank you very much, Dr. Pry.

The next panel is the representatives from the Bureau itself, led by the Director, Dr. Ernest Ambler, accompanied by Dr. John Lyons, the Director of the National Engineering Laboratory; Dr. Lyle Schwartz, Director of the Institute for Materials Science and Engineering; Dr. Donald Johnson, the Director of the National Measurement Laboratory; and James Burrows, Director of the Institute for Computer Sciences and Technology.

The Chair would recognize Mr. Boehlert for an opening statement at this point.

Mr. BOEHLERT. Thank you, Mr. Chairman.

While our distinguished witnesses are getting their places, I would like to have my statement for the record.

The proposed budget for the National Bureau of Standards is a sort of good news/bad news story. The good news, of course, is the recognition of the Bureau's pivotal role in maintaining the quality and technological leadership of U.S.-made products. The President's proposed 14 percent increase for the Bureau ends a prolonged run of stagnant budgets.

The bad news is the continuing effort to eviscerate the Bureau's fire and building programs. For the life of me, I can't understand the animus OMB has for these programs. Study after study has underscored their utility and their irreplacability. Most recently, the National Academy of Sciences issued a report urging the Federal Government to greatly increase its funding of construction research.

The FY '88 proposal quite literally adds insult to injury by cavalierly ignoring the agreement painstakingly hammered out by OMB and the Congress just a few months ago.

Suffice it to say that I intend to turn this NBS budget into a good news/good news story.

The National Bureau of Standards is the nation's oldest federal lab, and we should see to it that it is also the best. To be true to its mission, NBS must set the standard for research and excellence.

And let me add, if I may, parenthetically, that I was a little bit late coming in for Dr. Pry's opening testimony, because I had the privilege this morning, after I got off the airplane, of addressing the Engineering Society's Joint Government Affairs Conference here in Washington—engineers from all over the country, from a number of very fine organizations—and Dr. Ambler, you'll be pleased to know they enthusiastically endorse the budget request of the Administration. As a matter of fact, they lobbied on your behalf. They'd like me to push it up a little bit, if I can, and I assured them that I was so disposed.

Thank you, Mr. Chairman.

[The prepared opening statement of the Honorable Sherwood Boehlert follows:]

OPENING STATEMENT
CONGRESSMAN SHERWOOD BOEHLERT (R-NY)
NATIONAL BUREAU OF STANDARDS AUTHORIZATION FOR FY 1988
MARCH 3, 1987

MR. CHAIRMAN:

THE PROPOSED BUDGET FOR THE NATIONAL BUREAU OF STANDARDS IS A SORT OF GOOD NEWS/BAD NEWS STORY.

THE GOOD NEWS, OF COURSE, IS THE RECOGNITION OF THE BUREAU'S PIVOTAL ROLE IN MAINTAINING THE QUALITY AND TECHNOLOGICAL LEADERSHIP OF U.S.-MADE PRODUCTS. THE PRESIDENT'S PROPOSED 14 PERCENT INCREASE FOR THE BUREAU ENDS A PROLONGED RUN OF STAGNANT BUDGETS.

THE BAD NEWS IS THE CONTINUING EFFORT TO EVISCERATE THE BUREAU'S FIRE AND BUILDING PROGRAMS. FOR THE LIFE OF ME, I CAN'T UNDERSTAND THE ANIMUS OMB HAS FOR THESE PROGRAMS. STUDY AFTER STUDY HAS UNDERSCORED THEIR UTILITY AND THEIR IRREPLACEABILITY. MOST RECENTLY, THE NATIONAL ACADEMY OF SCIENCES ISSUED A REPORT URGING THE FEDERAL GOVERNMENT TO GREATLY INCREASE ITS FUNDING OF CONSTRUCTION RESEARCH.

THE FY 88 PROPOSAL QUITE LITERALLY ADDS INSULT TO INJURY BY CAVALIERLY IGNORING THE AGREEMENT PAINSTAKINGLY HAMMERED OUT BY OMB AND THE CONGRESS JUST A FEW MONTHS AGO.

SUFFICE IT TO SAY THAT I INTEND TO TURN THIS NBS BUDGET INTO A GOOD NEWS/GOOD NEWS STORY.

THE NATIONAL BUREAU OF STANDARDS IS THE NATION'S OLDEST FEDERAL LAB, AND WE SHOULD SEE TO IT THAT IT IS ALSO THE BEST. TO BE TRUE TO ITS MISSION, NBS MUST SET THE STANDARD FOR RESEARCH EXCELLENCE.

THANK YOU.

Mr. **Walgren**. Thank you, Mr. Boehlert.

Well, then, let's turn directly to Dr. Ambler. I notice you've been joined by Mr. Kammer, and we welcome you, Mr. Kammer, to these proceedings.

As I said at the outset, written statements will become part of the record without more, and please feel free to focus on those points that you would really like to underscore and raise for discussion.

STATEMENT OF DR. ERNEST AMBLER, DIRECTOR, NATIONAL BUREAU OF STANDARDS, U.S. DEPARTMENT OF COMMERCE, ACCOMPANIED BY RAYMOND G. KAMMER, JR., DEPUTY DIRECTOR, NATIONAL BUREAU OF STANDARDS; DR. JOHN W. LYONS, DIRECTOR, NATIONAL ENGINEERING LABORATORY; DR. LYLE SCHWARTZ, DIRECTOR, INSTITUTE FOR MATERIALS SCIENCE AND ENGINEERING; DR. DONALD R. JOHNSON, DIRECTOR, NATIONAL MEASUREMENT LABORATORY; AND JAMES H. BURROWS, DIRECTOR, INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY

Dr. **Ambler**. Thank you, Mr. Chairman. I am pleased to be here to request authorization of appropriations for the National Bureau of Standards for Fiscal Year 1988.

You have introduced the senior managers of the National Bureau of Standards who accompany me.

For Fiscal Year 1988, we are requesting $138.6 million, $16.6 million more than Congress appropriated in Fiscal Year '87.

This is the first time since Fiscal Year '82 that we have requested any significant overall budget increase, and this is very good news and, I believe, significant, because it reflects a deeper recognition and what I hope will be a deepening recognition of the importance of the National Bureau of Standards to U.S. industry and to our international competitiveness.

Central to the legislative mission of NBS is providing a range of technical services, such as measurement procedures, test methods and evaluated technical data on which industry relies for quality assurance of products and services, effective and efficient control of processes and procedures for design and redesign of products. These are all necessary ingredients for a more competitive America, and they are especially important as we focus on new and emerging technologies.

In my testimony, I give a number of examples of how we have worked closely with industry to produce substantial national benefits. I refer to the work on the automated manufacturing research facility, and to a very important and exciting development on measuring magnetic microstructures that has raised considerable interest with those who manufacture magnetic storage media. We have been extremely active in standards related to computers and in a number of different areas.

And equally as important as the specific type of technical work we do is the way we get the job done. We work very often in a cooperative mode with companies, with trade and professional associations, government agencies, and researchers and universities. You mentioned the Industrial Research Associates that we have and guest workers, and Dr. Pry, in his discussion with you, was talking about the importance of this working together as the best mechanism for technology transfer. And we try to do that, because we certainly believe in that point of view.

Getting people together constantly is essential, and we run major conferences and workshops with the private sector all the time, more than two major ones a week, at the Bureau.

We also keep track of what other nations are doing in standards development in order to assist U.S. companies and organizations to prevent measurement and standards barriers from being erected to the entry of American products into foreign markets.

The '88 budget reflects the Bureau's key role of supporting industry by placing emphasis on further enhancing the U.S. competitive position. There is a request for $3.5 million for process and quality control. This is the third request that we've made in this particular area, Congress having granted us increases on two occasions in the past. This is for doing the very sort of thing that you were expressing concern about to Dr. Pry, the basic Bureau work as technology advances. As there are new developments, you have to provide the old services better, in a better scientific and technical way and in a more sophisticated advanced way, and this is aimed at that sort of thing.

We have asked for an increase of $1.5 million for high-performance composites, $750,000 for bioprocess engineering, a request for light wave measurement technology for $500,000, and a request for a half million dollars for computerized reference databases.

It is true, as I think Mr. Boehlert pointed out, that a substantial portion of the increase for the '88 proposal, $13.7 million, is for adjustments to our base budget. This reflects the amount needed to maintain ongoing NBS programs, but that does include funding for the construction of the cold neutron facility. The amount of $2 million is the amount needed to bring last year's appropriation up to the annual level that we're going to be needing, so it's contained in the adjustments to base, but it is decidedly programmatic, and other parts of it deal with the Federal Employees Retirement System and several—well, two major safety-related modifications to the NBS facilities.

There is a decrease of $3.9 million included, reflecting the proposed combination of the NBS Centers for Fire Research and Building Technology into a single Center. The Center would receive $5 million and continue NBS efforts directly addressing health and safety, such as work on earthquake hazards, structural safety engineering, and studies on the toxicity of combustion products.

The measurement standards, test methods, and evaluated technical data, the area that NBS specializes in, must be viewed as an integral part of discussions about U.S. competitiveness. It is true that from time to time people do wonder about our name, as you reflected on again this year, Mr. Chairman, you know, I've never been very enthusiastic about trying to figure a way to change it, although it does have shortcomings from the point of view that you've expressed. But the kind of thing that we do and the kind of thing that Congress mandated that we do on March the 3rd, 1901, so today is our birthday, as it were, is—perceived then as being essential help to U.S. industry.

It still is. The very nature of it has not changed in principle. What has changed is this need for more of it. Technologies have advanced, the industries are bigger, and it's important. We are very pleased to do it, and I think over the years we've sort of figured out how to get the job done.

And if it was then important, it is today when industry has got to pay more attention than ever to process and quality control, to take the lead in exploiting emerging technologies. Our economic well-being over the next several decades depends on it—I mean, not just our economic well-being, our national well-being in every respect depends on it.

And the budget request from NBS is an important step in providing the technical help industry needs. I followed with great interest your dialogue with Dr. Pry about the level of the NBS budget, and let me tell you, just to come up here and tell you we're asking for an increase, the first time since 1982, it makes me feel great. It may have shortcomings, and maybe it could be improved, but all things considered, considering that, you know, we have to be concerned about the deficit and other things. The fact that after lo these many years, I can come up and say, "The Administration is saying we can ask you for an increase," which overall is pretty substantial, makes me feel great, and I would like to feel that finally it's sinking in that the National Bureau of Standards really is doing something useful, because I think we are.

Thank you, Mr. Chairman. I'll be glad to answer questions, and my colleagues will join in also.

Thank you.

[The prepared statement of Dr. Ernest Ambler follows:]

U.S. DEPARTMENT OF COMMERCE
STATEMENT OF ERNEST AMBLER, DIRECTOR
NATIONAL BUREAU OF STANDARDS
BEFORE THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
ON AUTHORIZATION OF APPROPRIATIONS FOR FISCAL YEAR 1988
March 3, 1987

Mr. Chairman and Members of the Subcommittee:

I am pleased to appear before you today to request authorization of appropriations for the National Bureau of Standards (NBS) for Fiscal Year 1988.

Accompanying me are:

--the Deputy Director of NBS, Mr. Raymond G. Kammer;

--the Director of the National Engineering Laboratory, Dr. John W. Lyons;

--the Director of the Institute for Computer Sciences and Technology, Mr. James H. Burrows;

--the Director of the National Measurement Laboratory, Dr. Donald R. Johnson; and

--the Director of the Institute for Materials Science and Engineering, Dr. Lyle H. Schwartz.

For FY 1988, we are requesting 138.6 million dollars, 16.6 million dollars more than Congress appropriated for FY 1987. This is the first time since FY 1982 that we have requested any significant overall budget increase.

Central to the legislated mission of NBS is providing a range of technical services -- such as measurement procedures, test methods and evaluated technical data -- on which industry relies for quality assurance of products and services, effective and efficient control of processes, and procedures for design and redesign of products. These are all necessary ingredients for a more competitive America, and they are especially important as we focus on new and emerging technologies. Here are some recent examples of how we have worked closely with industry to produce substantial national benefits:

o We completed construction of the nation's most advanced automated manufacturing research facility -- the AMRF. At least 20 companies have commercial adaptations of portions of AMRF research and 10 automation and robot performance standards have been adopted or are being considered as a result of our work. With NBS' help, ideas from the AMRF now are being adopted at Navy-supported facilities in South Carolina and California.

o We developed an entirely new instrument for observing the magnetic structure of surfaces at very high magnifications.

We have formal collaborations with major industrial firms, including Kodak, Westinghouse, Control Data Corporation, Harris Electronics, as well as the Naval Surface Weapons Center. Perkin-Elmer is getting ready to market a commercial version of the device. The Bureau's development will help electronics and computer firms, among others, who are locked in international competition to develop smaller, faster, and higher-capacity magnetic information storage devices -- a large and rapidly growing market.

o We developed several key standards that will allow computer graphics programs to be moved from one computer system to another. This and other computer-related work by NBS is making major contributions to the development of voluntary industry standards for linking off-the-shelf commercial hardware, software, and data communication products. Our work is also helping to assure that international standards reflect U.S. technology. Computer security assistance from NBS has helped the banking industry and the Department of the Treasury to protect trillions of dollars of electronic financial transactions. Among our latest accomplishments is a test system for validating commercial devices that authenticate messages, an important security technique.

o We developed and patented a novel, low-temperature method to synthesize ceramic powders which should help overcome processing difficulties and defects for this high-technology material. More than 1000 industrial and other organizations have contacted us about this process.

I have attached to my testimony additional examples of this kind of work.

Equally important as the specific type of technical work we do is the way we get the job done. Very often we work cooperatively with companies, trade and professional associations, government agencies, and researchers from universities. For instance, more than 200 scientists and engineers from industry work at NBS. About 700 guest researchers from universities and from overseas also spend time in our laboratories.

We bring together industry representatives to discuss technical issues in order to identify for removal measurement barriers which stand in the way of new and improved products. Last year we hosted 115 major conferences with about 16,000 attendees. We held another 600 workshops and seminars, and reported our work in 1,600 technical publications and another 1,000 technical talks. NBS experts participated in the private standards writing systems by having more than 1440 committee memberships.

We also keep track of what other nations are doing in standards development, in order to assist U.S. companies and organizations prevent measurement and standards barriers being erected to the entry of American products into foreign markets.

Our budget request for FY 1988 reflects the Bureau's key role of supporting industry by placing emphasis on further enhancing the U.S. competitive position.

We are requesting 3.5 million dollars for process control and quality assurance projects which would permit the Bureau to develop advanced primary standards and measurement methods to increase industrial productivity and product quality. These improved measurement capabilities will help plant engineers and operators to more directly monitor the production process and correct problems on the spot. Working standards in industry demand more accuracy than is now available through some of our services. By increasing our joint efforts the result will be higher quality products with fewer defects and rejects. Congress provided funding in both FY 1985 and 1986 for the first phases of work in this category. This year's request is for additional improvements identified as having a high priority by industrial and professional organizations.

The proposed increase of 1.5 million dollars for high-performance composites reflects the tremendous market potential for these materials which offer advantages in strength and stiffness, corrosion resistance, manufacturing flexibility, and critical materials conservation. The aircraft "Voyager" offers a dramatic glimpse at the potential of composites. Its round-the-world flight would not have been possible without the availability of one of the new, advanced materials, a graphite fiber composite which comprised 90 percent of the Voyager's basic structure.

The United States is ahead in applying advanced composites to defense and aerospace needs, areas where cost and process efficiency are secondary to absolute performance requirements. But high scrap rates and possible failure during long-term performance are key technical barriers that limit the full commercial exploitation of these materials. Overcoming these barriers will require better information about the relationships between structural defects and the properties of the material. Our initiative would permit us to develop basic information and measurement methods needed in the area of polymer composites.

The proposed increase of 750 thousand dollars for bioprocess engineering would enable us to develop engineering measurement techniques and reference data to support biochemical manufacturing. Right now, the United States leads the world in genetic engineering and biological sciences, but we face stiff competition in extending this laboratory technology to the manufacturing plant. NBS has the opportunity to stimulate this developing industry by providing measurements, data, and models for scaling up biochemical processes. We plan to focus on improved design and control of bioreactors and chemical separators in order to improve product yield and quality. By providing this information, NBS will help American industry to accelerate the commercialization of bioproducts and penetrate faster the world biochemical market, projected to be in the 40-100 billion dollar range by the year 2000.

Lightwave measurement technology supports optical telecommunications where light and hair-thin glass filaments rather than electricity and copper wire are used to transmit information. Because of the advantages of high information-carrying capacity, attractive cost, and better immunity to electronic interference, the use of this technology for communications continues to grow, both in the United States and worldwide. The market is now estimated to be about 1.5 billion dollars per year, and it is advancing at a 20-25 percent rate annually.

The future of this emerging technology rests on R&D toward high-performance products, quality assurance during manufacturing, and compatibility among components. That is precisely what the NBS program increase of 500 thousand dollars aims to do. With the FY 1987 funding provided by Congress, we began to extend work beyond the optical fibers to other critical components of these systems -- such as light sources and detectors. We now propose to move faster and to expand our work into optical couplers and modulators.

Our science and technology enterprise depends on the availability of reliable reference data. Scientists, engineers and technicians need rapid access to accurate data on the properties of materials and the characteristics of chemical reactions. To help these people to effectively gather and use scientific and technical information, we are requesting an increase of 500 thousand dollars for a pilot program to produce selected computerized reference databases. Building on our experience in computerizing reference data, the pilot effort will assess the costs of maintaining an up-to-date system and will determine the potential for maximum cost recovery through the sale and lease of data products.

A substantial portion of the increase in our FY 1988 proposal--13.7 million dollars--is for adjustments to our base budget. This primarily reflects the amount needed to maintain ongoing NBS programs at their current level in FY 1988. It includes funding for continued construction of the cold neutron research facility, employee pay increases and contributions to the new Federal Employees' Retirement System, as well as increases for communications, utilities, and other cost of living items. It also includes funding for several safety-related modifications to NBS facilities.

A decrease of 3.9 million dollars is included in the FY 1988 budget, reflecting a proposed combination of the NBS Centers for Fire Research and Building Technology into a single center for fire and building safety research at a funding level of $5.0 million. This center would receive $5.0 million and continue NBS' efforts directly addressing health and safety, such as work on earthquake hazards, structural safety engineering, studies on the toxicity of combustion products, and the computer modeling of smoke and fire spread.

Measurements, standards, test methods, and evaluated technical data -- the areas NBS specializes in -- must be viewed as integral parts of discussions about U.S. competitiveness. We know that these NBS contributions to technical research and support foster scientific and technical advances and improved products.

Industry has to pay more attention to process control and quality assurance in its existing technologies. Industry also must take the lead in exploiting emerging technologies. Our economic well-being over the next several decades depends on it, and the budget request for NBS is an important step in providing the technical help that industry needs.

Before I conclude, Mr. Chairman, I want to comment briefly on H.R. 812, the National Quality Award Act. I wish to join Secretary Baldrige in enthusiastically endorsing the concept of this proposal. With a minimum of Federal intrusion and at no cost to the taxpayer, H.R. 812 seeks to encourage effective quality management all the way down to the factory floor and is consistent with the President's goal of assuring American competitive preeminence -- "the quest for excellence". The first step toward that goal is to establish a national commitment to quality control, and H.R. 812 addresses that issue. The responsibilities this bill would assign to NBS complement the NBS mission of enhancing the quality of American products and services.

Thank you, Mr. Chairman. I shall be glad to answer any questions you may have.

ADDITIONAL RECENT NBS ACCOMPLISHMENTS

- Working with the Westinghouse Research and Development Center in Pittsburgh, we developed special integrated circuit test structures that are incorporated into an "expert system" to control circuit manufacturing processes. This advance holds great promise for improving quality control, reliability, and productivity in the U.S. semiconductor industry.

- Our work with the American Iron and Steel Institute led to the demonstration of an advanced ultrasonic system for detecting faults within thick, hot steel. The industry estimates that this sensor system could bring annual savings of more than a million dollars in each of about 50 steel production facilities around the country.

- The practicality of using microwave technology to dissolve chemical samples more safely and efficiently than traditional labs has been demonstrated by joint research with a North Carolina-based firm, CEM Corporation, in the Bureau's laboratories. Because it is 10-100 times faster, this method could have a major effect on the speed and way millions of chemical analyses are performed every day.

- With support of the Department of Energy, we developed a procedure to fabricate thin-film temperature sensors on ceramic diesel engine components. These devices, which are more accurate and can be used to monitor the temperature of piston crowns, cylinder heads, and valve seats, will aid in the development of ceramic engines.

- Collaborating with industry, we made available several computerized databases for thermophysical properties of industrially important chemical compounds, for the performance of metals exposed to corrosive environments, and for thermodynamic properties of key industrial fluids. These easy-to-use references will aid scientists and engineers in the electric power, materials, and chemical process industries, among others. A separate computerized model to calculate the thermophysical properties of supercritical fluids is expected to have a significant impact on the design and operation of industrial heat exchangers, pipelines, and chemical separation equipment.

- We developed several new techniques for examining sintering of ceramic powders--the process by which the powders are compacted and heated to achieve their strength. Working with the Department of Energy and industry, we also came up with an inexpensive apparatus to measure the tensile strength of ceramics, traditionally a complicated and costly test. In sample preparation alone, this reduces the cost of a single test from about $1000 to less than $100.

- By conducting workshops for suppliers and users of international standards for computer networking, and in other ways, we continued to support the development of test methods critical for easing computer-to-computer communications through networks. More than 200 computer and semiconductor manufacturers, word processing vendors, communications carriers, and industry and government users from the United States, Canada, and Europe participated.

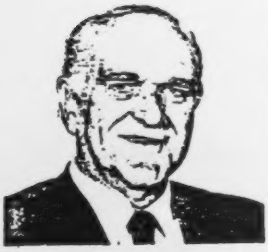
o NBS experts used newly developed computer tools to aid other federal agencies investigating the cause behind the New Year's Eve hotel fire in Puerto Rico that killed 96 people.

o We produced the first nationally recognized standards for helping industry to prevent or detect costly and sometimes dangerous leaks in a variety of products. These standards are expected to help assure the safe transportation of nuclear fuel and to improve the quality control of countless manufactured goods such as integrated circuits and refrigeration units.

o NBS researchers developed and now are trying out an experimental test for measuring the performance of high-speed supercomputers. Current performance measures are inadequate and stand in the way of making more effective use of these poetntially productivity-enhancing systems.

o Additional reviews of energy-saving ideas submitted by individuals, small companies, and others brought to 370 the total number of inventions recommended to the Department of Energy for possible support. A substantial percentage of the recommended inventions are for improvements in industrial processes, and a variety of these are already paying dividends by saving energy and creating new jobs.

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Gaithersburg, Maryland 20899
OFFICE OF THE DIRECTOR



JUNE 1985

ERNEST AMBLER, DIRECTOR

Dr. Ernest Ambler became the eighth Director of the National Bureau of Standards in February 1978. At the request of Secretary of Commerce Malcolm Baldrige, he has continued as Director for the Reagan Administration. Dr. Ambler joined NBS in 1953 and has worked throughout his career to make NBS an increasingly valuable scientific and technical resource for industry, business, government, education, and the public.

As Director of NBS, Dr. Ambler leads the Nation's measurement laboratory in the physical sciences and engineering. NBS directly supports the commerce, industry, and science of the Nation by producing and delivering measurement products and services. These products and services provide the basis for the exchange of goods, the accurate specification of products, quality control methods for production, and scientific advances. NBS contributes directly to the competitiveness of U.S. industry by maintaining and improving the Nation's measurement capabilities. The Bureau's headquarters are located in Gaithersburg, Maryland, with a second laboratory in Boulder, Colorado.

As a scientist, he has contributed directly to the state-of-the-art in measurement technology. His expertise in nuclear physics and cryogenics formed the basis in 1956 for a cooperative effort that disproved the law of parity conservation, a concept that nuclear scientists had adhered to for more than 30 years. This pioneering project confirmed experimentally the theoretical work of Nobel Prize winners T. D. Lee and C. N. Yang.

As an administrator, Dr. Ambler has helped guide Bureau operations and policies to improve the efficiency with which NBS fulfills its mission. His management responsibilities began in 1961 when he became Chief of the Cryogenic Physics Section. Four years later he was appointed Chief of the Inorganic Materials Division. In 1968, as Director of the Institute for Basic Standards, he assumed responsibility for directing the most basic of NBS research activities: developing and maintaining standard and measurement techniques for such quantities as length, mass, time and frequency, and temperature. He was appointed Deputy Director of NBS in 1973, and Acting Director in 1975.

Mr. **Walgren**. Well, we appreciate that statement, and certainly we are encouraged also by the recognition that you have received, the Bureau has received, in the funding priorities of the Administration.

And I think we're as much at fault as anybody in not being able to fully develop the role of the Bureau duirng these years, when i think it was obvious that the Bureau had the essential investment steps to contribute.

I'd like to ask you, would it not be true that the Bureau really should have an ever-expanding budget, without putting you in a position of getting you in trouble?

But the logic would be this, that if the measurement science should be ahead of the commercial development, in order to allow commercial development to occur, and if the society has an interest in commercial development, and we all know that any vibrant part of our society generated far more money than the research effort that's put into it, so if the Bureau of Standards should be ahead of the commercial development in research on measurement in new technologies, then for every new technology, we ought to be certainly doing more work or an incremental amount of work in those areas.

And as to whether it has a net expansion would depend largely on what you can stop doing, as older technologies are mature and there is no technological movement in those areas.

But if you would hypothesize that all areas of our economy are really continuing to move forward, and new technologies are being added, then the Bureau really should be doing more year after year after year; is that not a pretty good sense of direction that we ought to understand at the outset?

Dr. **Ambler**. Yes. I think if I may sort of set aside practical considerations of budget and the deficit and that sort of thing and answer the question, I think in the spirit in which it's asked, answer it theoretically, in principle, you know, somewhat academically, I think you're absolutely right.

I mean, first of all, what the Bureau does bears a direct relations to the gross national manufactured product. The gross national manufactured product contains more high technology or ought to contain more high technology constantly, so it's richer in technical content, as well as growing in size. And if you were to do an analysis of, say, what is spent on measurement-related activity, which is a survey we did many years ago, and it's staggering, then you'd day, okay, the gross manufactured product is increasing, the technology content is increasing, the amount of measurements having to be done and supporting all of that is increasing.

The National Bureau of Standards, you know, bears a direct one-to-one relationship with thatg. And theoretically, at least, your analysis, the conclusion of your analysis, is inescapable.

Mr. **Walgren**. And we should also appreciate, should we not, that the measurement is really a fractional investment? It is not a—certainly economic activity following thereon would generate far more wealth to the society than is represented by the investment in measurement.

Dr. **Ambler**. Yes, I think so. But I think even more important is that if you don't do the measurement, if you don't have the quality control, you're wasting all of the other resources. So it's an absolutely essential component.

Mr. **Walgren**. It is the enabling foundation for the private sector, and we really are about enabling the private sector to function perhaps more in this area then any other role of government that we can put our finger on. It really is an enabling function; is that—

Dr. **Ambler**. I think so, yes.

Mr. **Walgren**. Well, let me recognize Mr. Boehlert.

Mr. **Boehlert**. Thank you, Mr. Chairman.

Happy birthday. You don't look 86. On occasion I go down to the end. It's not because of any lack of interest. That's the only designated smoking area in the committees, so I have to go down ther every now and then.

You know, on page 2, Dr. Ambler, I assume in the second sentence youare using the "we" to reflect the Administration, because you say this is the first time since '82 we have requested any significant overall budget increase. That isn't exactly the case from the NBS point of viedw, is it? I mean you have been beaten back repeatedly by those bad guys downtown, haven't you?

Dr. **Ambler**. Well, I really meant that this is the first time I have been able to sit here in this seat and ask for it.

Mr. **Boehlert**. Well, I'm happy for you. It's something we welcome also.

Let me ask you, what progress is the Bureau making toward implementing the new personnel system that we required in the FY '87 authorization?

Dr. **Ambler**. Well, we have got an extensive planning underway, and my able deputy, Mr. Kammer, is cracking the whip on all of that, so maybe he could just tell you how things stand there.

Mr. **Boehlert**. All right.

Mr. **Kammer**. We have devised our plan in early January. We have put our plan together, we had that done on January 5th. It is our plan to have the final plan for publication for the employees and general public, as is required by the legislation, in July, and after we receive comments on that, we will go to the final publication in September.

In addition to recently formulating our plan in what we regard as a satisfactory way, we have begun conversations with OPM. OPM has now named a contact point to work with us, and they have committed to support us in implementation of this, which was a matter of some discussion.

Mr. **Boehlert**. What about the reaction of the—your people? Are they pleased? Morale up?

Mr. **Kammer**. It's—among the managers, it's regarded as a very attractive idea. Among a lot of the employees, it's viewed with suspicion. I think the experience of most of our employees, and perhaps all government employees in the past few years, has been changes in the personnel system generally seem to result to the detriment of the employee, and—

Mr. **Boehlert**. That's a perception, not necessarily the fact.

Mr. **Kammer**. I'm stating, we've——

Mr. **Boehlert**. Boehlert.

Mr. **Kammer**. We've started a series of conversations with our employees, started a newsletter, you know; the kinds of things one can do to make sure that people don't feel out of it. When you feel like you're cut off from the information, you become particularly nervous. Any normal person would, I think. But the general feeling when I talk with people is most employees feel that their retirement is threatened—not necessarily by this legislation, but their general experience of the last five years is the retirement is threatened, the decisions that have been made on pay don't always seem rational to them. The general rhetoric that they read in the papers and hear from people makes them feel that if people think that they're not working hard to a good purpose, then changes they'll make will be to punish them, or threaten them. So there's—that comes not necessarily from reading the legislation, but from the general environment, and we have an education job. Our people as a group are not all looking forward to it. They need to understand it, they need to feel part of the process.

Mr. **Boehlert**. How come no money in the budget request to implement the plan?

Mr. **Kammer**. There shouldn't be a requirement for a funding change in the '88 budget. The first day, if you will, of implementation will be January 1st of calendar year '88, which will be three years into fiscal year '88.

Our intent, unlike—when China Lake converted, they sort of gave everybody a pay raise in the process of conversion, I think to make them feel better about the change, which ultimately added 5 percent to the personnel costs, or at least the GAO study suggested that's what happened.

Our intent is to convert people on a same dollar basis. We don't see why there should be a change in income on the face of it.

Now, performance and changes that people that prosper under the system because of their level of performance, because it is a paper performance system, will get pay increases over time.

Mr. **Boehlert**. Don't you think the combination of this innovative approach to rewarding excellence, plus the budget increase requested by the Administration, is going to be helpful to you in recruiting? That's been a problem in the past; you try to recruit some of the best young talent, and they say, "Hey, nobody cares about NBS, they want to slash all the time, no future there." We're at the turn-around point, aren't we, on their 86th birthday?

Mr. **Kammer**. We think it's outstanding. We're very enthusiastic about the—the personnel system, and one of our major future problems, as you, I think, probably recall from when you're considering the legislation, is about 36, 37 percent of our technical professional staff will be eligible to retire of their own election in the next five years.

To recruit a replacement crop for, let's say only half of them decide, and we're looking at maybe a 20 percent change in our senior technical staff, is a very formidable task, and our ability to do this successfully and in the time period that's going to be allowed for us to backfill these, is contingent on having the kind of inducements that are provided by this legislation, the kind of flexibility. Because it reduces the procedural overhead on recruiting by—from six, eight months in some cases down to, one can imagine doing it in about six weeks, which is just a major change. It's the difference between getting people and not getting them in a lot of cases.

Mr. BOEHLERT. Dr. Ambler, is the funding from the other agencies of the federal government remaining stable, or what's the trend line?

Dr. AMBLER. The trend has been to—overall that it's been increasing somewhat. It's been going up at about the rate of 5 percent a year.

Mr. BOEHLERT. Are you pushing in this area? Or is it——

Dr. AMBLER. Yes. I—we're very careful that we only take on that work that sort of is a match to the mission, but, yeah, we've been taking on more, particularly in the—from the Defense Department.

Mr. BOEHLERT. Is there—this is probably an unfair question, but I'm noted for them. Is there anywhere in the Bureau that with a straight face, and without crossing their fingers and look me in the eye and say you accept and endorse what OMB did with CB—CFR and CBT?

I'm looking to see if you crossed——

Dr. AMBLER. Well, I'm looking you straight in the eye, sir, and I'm flashing the back of my mind, the last five years, when the Bureau's been in this nutcracker between that and the cold neutron, and I thought it was—was a tremendous thing when the Administration and Congress worked out the compromise last year. I just breathed a big sigh of relief and figured okay, now let's set all that behind us, because we can—we can build from here, and I'm sorry, it seems to have become a bit unraveled——

Mr. BOEHLERT. Through no fault of ours, I might add. I won't ask you to——

Dr. AMBLER. Yes, well, I'd like to see it—I'd like to get out of the nutcracker again, if I can.

Mr. BOEHLERT. What about—do you have any organized plan to outline the problem mentioned by Dr. Pry, that is not getting the small businesses to participate as much as you or they or I would like?

Dr. AMBLER. Well, we don't have a comprehensive plan for the whole thing. We are very much aware of the problem, and in a number of areas we do work with small business—a lot of instrumentation companies are fairly small businesses. So it works fine there, but you know, that's direct, because they're in—they're in our kind of business.

More generally, though, we have been really trying to figure out what to do with respect to AMRF. See, the AMRF was undertaken—I forget how many years ago—several years ago—when we first got an appropriation to get into automation from Congress, to deal with these questions of interfaces and the—in the automated factory, and we realized at that time that batch manufacturing was small business. So we really knew who the audience was that we're shooting for.

Well, it hasn't worked out quite satisfactorily from that point of view. On the other hand, the AMRF, by any measure, has been an outstandingly successful program, and there's a tremendous amount of technology transfer going on. It tends to be with the bigger companies, the General Motors, the Boeings. A lot of the machine tool manufacturers, computer manufacturers. And they in turn are introducing things that the smaller businesses can use.

So it's happening in that way. But we are still not satisfied and we have been coming to grips with the problem for over a year now, and trying a number of things that didn't work too well.

One of the problems is the small business people, an awful lot of them, you know, you can't deal with them with one-on-one. You've got to have some intermediate mechanism for doing it, and the conspicuous thing here is that there are no consultant systems integrators.

I mean, for example, you take the situation, office automation. I mean you've got a business, you know, where you've got several outlet stores and central processing, whatever it is you're doing, and you know, you're a small business. You can hire very capable companies to set up your accounting system, you know, your inventory systems, your point of sale systems, computer it all, set it up, train your people, troubleshoot, have a contract. You can order a—the whole ball of wax and get good product. You're talking about doing the same thing in manufacturing as opposed to that business—totally absent, in anybody.

So we thrash it around a little bit and see whether there are people who can take that on, and we do have some leads. But the other thing that we're trying is that we've decided that we will take our own machine shop—this is sort of what we started to do, you know, to make our own machine shop a place where we do all these experiments. It tends to be a bit separate, although it's in the same area. And we're going to set up a mini-AMRF, as it were. See, the things that the AMRF has proved, and we know will work, will probably be about—about the year 2000 is when it will all be implemented. Not—and these smaller companies want something sooner.

So what we're going to do with this mini-place is that we're going to leave out a lot of things. We're going to leave out robots. We're going to leave out transfer lines. But we're going to have PC, personal computers that will operate CAD/CAM systems and numerically controlled machines. We know we can do that. Greatly simplified.

And we're going to put that together, which we know we can do, and see if—whether that isn't a little bit of a better touchy-feely thing, where the small people can come in and say, yeah, there's something I can learn from that. Because we did invite a whole bunch of small manufacturers in, but you know, they were a little overwhelmed with what they saw, and I think we have to make it simpler.

So, no, we don't have a comprehensive plan. We do realize what the problem is and——

Mr. **Boehlert**. Do you have a—do you have an Outreach Program, for example, with National Association of Manufacturers with, you know, a focus on the small business?

I'm not sure NAM membership——

Dr. **Ambler**. Well, I think we work with every association, you know, that's relevant to this end. No, I don't——

Mr. **Boehlert**. And is one facility here enough? I'm not advocating more, I'm just probing.

Dr. **Ambler**. No, I—I don't think so. It just happens that this is an area where—where, you know, we know we have this problem with the small manufacturers in spades. We did set out to tackle it and so, you know, unless we can lick that problem, you know, we're not likely to be able to solve all the others, either. So that's why we're—we're focusing on that one. I think Dr. Lyons wants to—wants to answer.

Mr. **Boehlert**. Dr. Lyons?

Dr. **Lyons**. I think one of the most remarkable developments of this decade has been the transformation of most states from what I would call technologically illiterate to very sophisticated stimulators of technology. That's true of almost all states now. And it seems to me that what we really need to do is create an opportunity for 50—at least 50—intermediaries, and we are looking very carefully at what the states can do and the various mechanisms, and they're very diverse.

As you know, we've been working, for example, through SUNY-Utica in one aspect of this problem. Pennsylvania has all kinds of mechanisms in place now for Ben Franklin Centers to Penn-TAP and so on. We find this evolving in similar ways in most states. Almost all 50 of them have things like this now that one can go and touch and talk to someone about. In Maryland we have worked with the state university which has an engineering research center, not an NSF center, but something else with the same name, which is designed to reach out to small companies. They also have an incubator, as does RPI and Georgia Tech and so on.

So there are, all of a sudden, a lot of state mechanisms available to us that simply didn't exist as recently as 1980. We are thinking hard about that. We don't have an overall concept. We are still doing piecemeal things, working with Wisconsin—Dean Ballinger, for example, and some training programs that he runs.

So we are very much in a—in a formative stage. We don't have firm ideas, but I am convinced that those—those state organizations can be of great use to us.

Mr. **Boehlert**. I'm working on a development of a legislative proposal to create a national technology extension service, and if so, I will be talking some more with you on that. We do a great job of reaching out to agriculture with the agriculture extension service. Unfortunately what it's doing now is telling people at urban centers how to plant gardens. I'm not sure that's its original mission, but we don't do enough in the outreach program, particularly for small businesses, in helping them with the latest technology, with the latest manufacturing processes, that type of thing. So I encourage you to keep up your effort to expand the outreach program.

Mr. Chairman.

Mr. **Walgren**. Thank you, Mr. Boehlert.

Let me ask each of you, I gather when you put together a budget, you—you look forward to what you are going to do that year, and at the same time you have a cut-off point that something that you wanted to do is not able to fit within the efforts that you chose.

In each of your areas could you give us a glimpse of what it is you're really going to be glad that you did for the American public in this coming year that you anticipate will be moved along through the programs that you're recommending to be a real tangible benefit?

And then secondly, what it is you—you regret most not being able to do in the budget this year. And why don't I just start down at the end and we'll go right down the line, and give us a glimpse of what these efforts look like from your budgeting approach.

Dr. JOHNSON. Okay. Thank you, Mr. Walgren.

Let me approach it from the process and quality assurance proposals, since most of that is in my area, I can perhaps summarize that best for you.

You might remember when we began with our proposal, as Dr. Ambler indicated, we began about three years ago, and at that time the original proposal was about $13.5 million, and a total of 30 projects. We have received funding on two occasions now, which total about $2.5 million, and we are requesting funding this year for about $3.5 million. That will allow us to address a total of about 15 of the projects that we originally proposed, roughly half of what was originally proposed.

We have been forced to reprogram a little bit of our own resources, about a million seven in the area of frequency standard development, just because the pressure was so great on us to pursue the development of the last version of the cesium frequency standard. We had so much request and pressure from outside, we had to move on that. But we still had a balance that remains there that we are not able to address. A big chunk of that balance is in the chemical measurements area. And we have had to set that aside a bit, but we have also redressed the needs in industry. We have taken a look at what the demands for services really are there, and I think if you've been reading The Wall Street Journal recently, you've noticed a series of articles on serious problems in chemical measurements. They abound in industry. And I think our greatest pressure from the outside for increased services in this general area of measurement services.

As far as what can we do with the money that we are asking for, this year the $3.5 million, that will cover initially a total of about 10 projects, and I might just mention one of them because it's closely related to a comment I made earlier. I mentioned to you we were pressed to reprogram some of our own resources in the time and frequency area to develop the sort of last generation of cesium frequency standards. With the new money we are requesting, we are hoping to be able to pursue the development of the next generation of time and frequency standards, the time and frequency standards of the 1990s, which will be based on cooled ion technology, which is a technology that's been developed primarily at the Bureau of Standards. That's just one of the projects, Mr. Walgren. I could elaborate on other ones for you, but just to give you a flavor, that is a—a forward looking direction. It will result in a primary standard for the United States that we believe will be far better than anything anywhere else in the world. It will be in place by the middle '90s, and it will be something that will be funded directly out of this $3.5 million that is being requested this year.

Mr. WALGREN. And what will some of the near-term applications of that standard be?

Dr. JOHNSON. Well, in the near term, we will be using the—the last generation of cesium technology for standards. That standard is currently under development. It will be ready within the next year or two. Primary time standards are used, of course, to control our whole system of time dissemination, a very elaborate system. It operates ranging from time of day services to satellite distribution of time services, used for commercial navigation. It's used for a very large variety of coordinating purposes, coordinating, for example, the switching of large power grids, as one major power company buys power from a neighboring power company. It's necessary to synchronize very carefully. They use our time services to do that.

So in terms of real practical commercial applications, this is a business where we are working right at the state of the art on a daily basis in contact with our customers on a daily basis, and the current technology in the laboratory is being pressed very hard by commercial applications.

Mr. WALGREN. Thank you. Dr. Lyons?

Dr. LYONS. Thank you. A lot to talk about.

In manufacturing engineering, a subject we were just discussing, we have passed a key milestone. We have been for five years, I guess now, building the AMRF. We declared it completed in December, and are now engaged in the long term program of research, further research on measurements and interface standards for that very important subject.

We've also initiated a new program in length measurement where we are reaching out, trying to make measurements in a nanometer scale which is about a thousandfold better than we have been able to do. That's of obvious importance to the integrated circuit industry, among others.

We have made two important new starts, one in bioprocess engineering, using competence funding and other flexible sources of funding in order to ramp up for the funds that we are requesting this year in the—in the budget. And last year you know that we got the first increment of funding for work in light wave metrology, which is fundamental to optical communication systems, so we're getting a start there. We put a program together. We are in for another increment there.

We have defined some much-needed in the electronic chip manufacturing. As you probably know, there's a great deal of concern being expressed around Washington about the vulnerability of our nation to lack of leading technology in making electronic chips, and we are looking at our program to define some new needs there.

And then in fire research and building technology, I have both technical progress to report and very visible efforts to report. As you will hear on Thursday, I believe it is, in the hearing, the Center for Fire Research made notable contributions to the study of the unfortunate hotel fire in Puerto Rico, using some of our models to explain what actually happened in the—in this very rapid development of that fire.

More importantly, in the long run, we have made great progress in developing our models for fire, and I'm sure Dr. Snell will talk to you about that during that hearing.

In the building technology area, the most visible thing we are doing right now is studying the Embassy Building in Moscow. I am just back from visiting that myself, and there will be a report to the Congress in April on that. Again, more important in the long run is our work in computer integrated construction, where we are applying the power of the modern computer to attempting to improve the competitive posture of the construction industry.

So those are a few of the significant developments in engineering at NBS.

Mr. WALGREN. How about the things that you will be sorriest you weren't able to do this coming year?

Dr. LYONS. Well, I think primarily your—the committee is aware that our work, for example, in light wave was defined initially as a $10 million program. We are working at getting funding for that. We are getting it in pieces, and so we are in a sense laid back on that program from the posture that we would ideally like to be in. Nonetheless, we are getting a good start.

Mostly it's a matter of speed with which we can mount these programs, and I think the subcommittee is aware of the subject matter we want to do. It's just that we can't have it all at once.

Mr. WALGREN. I see. Okay.

Dr. Schwartz?

Dr. SCHWARTZ. Let me speak to three of the activities that have progressed very rapidly in the last year. One, of course, as you are well aware, we did get a beginning on the cold neutron facility finally, and we are very excited at the fact that we are engaged in that effort. The cold neutron source itself is going to be introduced into the reactor at the end of this month at the time of the normal shutdown. It's been tested now and is ready for insertion.

I might add, of course, that we are a little frustrated it's taken us that long to get to this point, but now that we are really moving, we intend to move as rapidly as the engineering schedules will allow us.

With regard to the area of ceramics, we began a program a year and a half ago and now have—have reached the full level of funding in that initiative, and we are able to point to significant progress in a number of areas in ceramic science and engineering that simply would not have been possible. I'll just mention one as a simple and direct example.

Any time you use a ceramic material, it's necesary to know how strong it is before you introduce it into structural application, and in the last year we developed a new test procedure that will reduce the cost of measuring that strength by a factor of about 10, a very significant increase in the flexibility that's implied by that ease of measurement.

In the third area, which I know is an area of some considerable concern to this subcommittee, the activity associated with support of the steel industry. We have made very significant progress in a number of the projects which we engaged in a year and a half ago, in particular in the area of steel sensors. We have actually transferred one of the sensors to the industry already, and a second one is ready for test on line in one seal company this spring.

With regard to your question about what we would like to be doing that I'm a little frustrated about, I think my answer is similar to Dr. Lyons. We have before you for consideration an initiative in the area of composite materials, and again we would certainly propose to move more rapidly than the proposed budget would allow us. That program was originally scoped at a steady state of 6 million and, as you see from the proposed budget, we would begin at approximately one quarter of that level and anticipate moving ahead in the future.

Mr. WALGREN. Mr. Burrows?

Mr. BURROWS. Yes, Mr. Walgren. The early part of this year we spent a good deal of our time trying to maintain the confidence which we had in the protocol area by finding funds within the government to—to displace the funds that we got directly from Congress to—to work that area. We've done a very good job of getting mostly Department of Defense funds to apply the technology and keep the people, in terms of applying it in the Department of Defense and throughout the government.

I think we have to keep those people onboard for—for more than just using it in the government. I think protocols are going to continue to develop, especially in the higher speed telecommunications area, and we are going to have to be—we will be, I think, a player in that game when it comes about.

In the area—in other areas we've—we're in the process of getting accepted by both industry and the users a definition of an operating system called POSICS, which is now a partial standard, and will become a standard so that we can get intermediate class machines bought with essentially UNIX space, but standard UNIX spaced operating systems, so that we can move our programs from machine to machine and move our people from machine to machine without training or reprogramming. And I think that's a very significant new possibility that was not possible in the last 10, 15 years.

In the area of security, I look forward to finding out what my role will be in security. I know that I have a current role, and people appreciate what we're doing, but I think there's a bigger program there, and I think it's a real program, and I hope to get on with it when we can get the authority to proceed.

There are other areas in telecommunications which I think are going to be very big, but we haven't even started attacking those yet. It's a case of last October, the definition of ADP was expanded by Congress to include part of telecommunications in it, data communications, and we haven't even planned what we ought to be doing in that area. But I think that's one of the areas we have to plan out this year.

Mr. WALGREN. So there's a lot that's undone, not even addressed. Can you—is there any generalization that can be made about the level of effort that we are making? Are we—I suppose that varies from project to project, but we are all operating under restraints, and so I'm sure that none of your efforts are being fully funded. Is there any generalization you can make from your areas about the kinds of levels that you think could be usefully—and really provide the—the research base that our goal is to provide?

Dr. AMBLER. Well, I think that the way Dr. Lyons and Dr. Schwartz expressed it is the correct way. We are in this budget proposal and in previous budgets have asked you to authorize us to get into fields of what we call emerging technology, and we have done a pretty good job of identifying those and getting a start.

I am kind of reluctant to say, you know, the $138.6 million falls short by so-and-so, because I am so happy to come up with 14.4 percent increase that I don't think I should, you know, be a hog about things.

Mr. **Walgren**. Well, I understand.

Well, okay.

Mr. **Boehlert**. I have one last one of Dr. Lyons. I asked the same question last year. I'd like a progress report. Where are we vis-a-vis the Japanese with respect to robotics?

Dr. **Lyons**. I'm not sure the answer has changed very much from last year. The Japanese use of robotics is still well ahead of our use. The laboratory situation, the technology generation in this country is still very strong, in fact, probably better, because things like the NSF engineering research centers, several of which are devoted to—either directly to robotics or to smart machines and manufacturing. So my sense is that we're doing even better in the laboratory. We're still doing very well with respect to the very smart ones—that is to say, those that depend on sophisticated software for their smartness, because the U.S. still had the lead there, and I think our computer people are being extremely innovative in——

Mr. **Boehlert**. Dr. Lyons, where do we fall down? We're so good at technology generation. I mean we win all the Nobel Prizes, and the Japanese win one about every 10 years. But yet they take our technology and put it into commercial application and—and really beat us in the international marketplace. Where are we falling down?

Dr. **Lyons**. Well, I'll give you my personal view. This is not exactly——

Mr. **Boehlert**. That's exactly what I'd like.

Dr. **Lyons**.—because we are talking about these things all the time, as you might imagine.

First of all, I believe that the generation of science and technology in this country is first rate, better than anyone else anywhere, still true, and I don't see any problem—

Mr. **Boehlert**. If we can quantify that, we can document it, so——

Dr. **Lyons**. Right.

Mr. **Boehlert**. So we're on the same wavelength there.

Dr. **Lyons**. Most thinking people would agree with that. I think we fall down in going to market, in the following respects:

We fall down in quality—this is outside, by and large, the laboratory. We fall down in cost. And we certainly are falling down in the speed with which we go to market. So while we may have the best idea, it doesn't do us much good if we're last in the market.

Now quality cost and speed to market have technical components that all the NBS programs address, but they also have serious nontechnical components that are cultural and financial and so forth. But I do not think that the fundamental problem is in the—in the research laboratories. There is this question, though, of going to market. I don't think going to market is what you would call technology transfer. I think of it in terms of a company, for example. You get a new idea, and you do some prototype product development, and then you begin to collect up your friends in marketing and in corporate engineering and in production, and you have to get the board to approve various levels of appropriation, and finally the organization as a whole goes to market.

If that's technology transfer, it's internal to that corporation, and there are all kinds of reasons why it doesn't go fast, some of which are—relate to financial markets and what I call the calculus of the board room. But I think things are, by and large, healthy in the laboratories, to the extent they're not being cut back.

Now you heard Dr. Pry say that various things are going on in our society which are cutting back some R&D programs. But if you look at—I think if you integrate over society the things that are coming out of the laboratories are still better than anybody else's. But we sure don't go to market very well.

Mr. **Boehlert**. I probably should ask this question of Lane Kirkland. Education is part of the problem, isn't it? Do you find the receptivity out there in the marketplace to—robots, for example? Isn't it common theory that, well, if you proceed with robotics development, you're going to displace American workers? I mean I hear that often, and my argument is if we don't, we're going to displace a hell of a lot more, because we won't have the marketplace any more, the other guys will have it.

Dr. **Lyons**. Well, there's certainly the argument that if we don't automate, we may not be able to compete with those who do, and the international aspect of that is what is driving a lot of the thinking in this country. Yes, there's an educational problem and a manpower problem. I think I testified up at SUNY-Utica on this point, where I think that the—the effect of automation on the work force will be to require that it will do different things. We will have to be able to deal with the sophisticated machines and we will have to be able to service them, we will have to be able to understand them, just as an airline pilot has to understand the latest in avionics. He may not be able to design it, but he sure has to know how to use it. That means there's an upgrading in the training of the work force.

If you go out to the AMRS, though, you will see the shop full of sophisticated people keeping that thing running. I'm not sure the term "unmanned factory" will ever be realized, but I think the men and women who will be there will be different. That's probably higher paid.

Mr. **Boehlert**. Thanks for the two plugs for SUNY/Utica.

Dr. **Ambler**. May I add something to the question that you asked Dr. Lyons?

Mr. **Boehlert**. You may.

Dr. **Ambler**. I think Dr. Lyons is perfectly correct. We have tried to think pretty hard about this problem, particularly this last year or a little longer. We do have one or two economists at the Bureau. I have been trying to challenge them to see, you know, just what the problem is.

In my opinion, and I think a number of us at the Bureau are coming to this conclusion, you have to look to the private sector, because as Dr. Lyons points out, the speed at which they introduce products takes too long compared to Japan, not fast enough. There are other questions of quality control and pricing, but the general speed at which our technology is developed here and converted into the product process is not fast enough.

Why is that? We really don't know, but certainly as we work with companies and look at it from the eyes of technologists, you know, you are looking at a business financial world, so you are looking at something you don't really understand very well, but it seems to us that the people in our industries are just as skillful as the Japanese, just as bright, work just as hard. It seems to us though that the incentives are all cockeyed. I mean, the rewards and incentives in our system is all for the short range.

You know, the monthly statements and so on. They make the most beautiful long range plans. The first sign there is trouble on the balance sheet, wham, it goes out the window, you know, there just isn't the commitment to the longer range.

I think Dr. Pry was alluding to this earlier. I think that is because, you know, our chief executive officers and captains of industry, their perks and rewards don't come for the long range. They come for the short range.

I think that's where you have to focus on looking at the problem, looking for answers. I don't think the answers are going to be found in technology as such.

Mr. WALGREN. Let me ask, you have initiatives in bio-process engineering, in composites and in light wave measurement, all of these funded only a fraction of what the Bureau asked for approval from the Department of Commerce.

What fraction would those things as a general matter be funded at of your request?

Mr. KAMMER. It's about a tenth.

Mr. WALGREN. One tenth?

Mr. KAMMER. About that.

Mr. WALGREN. So we are making about a 10 percent effort in areas that the Bureau requested a 100 percent effort?

Mr. KAMMER. Yes, sir.

Mr. WALGREN. I see. I think we ought to really also raise reservations on our part, speaking certainly for myself, about the user fees that are being anticipated in some of the reference data and the research assistance, where you are anticipating recovering, as I understand it, by fee, the expense of the research associates; is that right?

Mr. KAMMER. Yes, sir. The Bureau of Standards and the Department and OMB are in a conversation right now to see if we can think of ways to get the private sector to give us more money, I guess, is what it really boils down to.

This was not reflected in the budget itself as an offset or any of that kind of thing, as it might have in prior years have been. The reason for that is none of us can see totally clearly just how one goes about this and over the next couple of months, we hope to figure out a way of doing it that is reasonable and has some hope of working.

Mr. WALGREN. Would you be having to get authority from us to do that before you do it?

Mr. KAMMER. Our user fees have not in the past been constrained by legislation, except for the general provisions of government that prescribe you can't collect more money than the appropriate costs. You're not supposed to make a profit if you are the government.

Mr. BOEHLERT. Mr. Chairman, if I may, I would suggest that if you get down in the discussion stage with OMB and you develop a plan that you both sign off on, we are interested parties. While we might not have the authority to approve or disapprove, I think there is an obligation on your part to come talk to your friends up here who are vitally interested in that, because I certainly don't want to provide any disincentives, particularly for small business, to participate in your Guest researcher program, that type of thing.

If anything, I want to have greater utilization rather than the other way around, of your excellent facilities.

Mr. KAMMER. Yes, sir.

Mr. WALGREN. And there's the danger of being self defeating in this, as I understand it. The National Conference of Standards Laboratories believes that some of the services that we provide out of NBS are very high priced compared to what may be relied on otherwise, and therefore, an increase in user fees in that area is going to put you right out of business.

Dr. AMBLER. Well, I look at those issues a little differently. I certainly think I am going to be given the opportunity to talk to OMB about what in my opinion makes sense and charging an industrial research associate a $2,500 or whatever it is user fee is really missing the point. I mean, the point is what is being done cooperatively and compared to what they may be bringing to the table not only by way of salary but you know, they bring equipment and they bring specimens, materials, it really is not looking at the——

Mr. WALGREN. I gather if we can charge them an user fee, they really should be in the position to charge us as well. After all, they are bringing a lot to us. We want them to come.

Dr. AMBLER. Yeah. The user fee is just—I mean it's a small part of what they bring to the table, what the government benefits from also.

Mr. WALGREN. Well, I think——

Dr. AMBLER. Now, the other thing, the calibration fee, which I think NCSL is complaining about, I feel differently about. We charge—we don't charge long term research costs against calibration fees, although OMB would pressure us constantly to do that. We charge actual cost of service. They're expensive. Sure, they're expensive. They are the best services in the world. I mean, you know, if you could charge for research, you know, and sell it for less, you could maybe start a business and make a profit. I mean, nobody ever ran a real business, profitable business out of being a Bureau of Standards.

What they want when they come to the Bureau of Standards is a quality product, and they get a quality product. I'll stack the Bureau of Standards up against any other national laboratory in the world. You know, the price isn't too much. We are charging them what it costs to get the job done. You know, it seems to me that it has been a reasonable—I think the National Conference of Standards Laboratories have reason to complain that we are not providing a range of services that meet their requirements. That, I can admit. The fact for those services that we are supplying, we are charging too much, I find that a little hard to take. I find it particularly a little hard to take coming from the National Conference of Standards Laboratories, who consistently complained about our microwave measurement area.

I have spent three years of hard work with one of my people full time in the Defense Department trying to get this sorted out, because a lot of those microwave measurement requirements come from the Defense Department, with modest success. We got some increased funding in MILSTAR. A lot of effort, medium kind of success.

I've also observed that a lot of those are not defense oriented, and do you know, we do not have one single industrial research associate from the microwave business and we never have had one? Now, that's not putting, you know, money where the complaint is.

I have written some six months ago to four chief executive officers of companies, big NCSL members, saying, look, I'd like to sit down and meet with you about this, and let's talk it over, maybe we can get some kind of consortium going, you know, cost sharing. I still haven't got a meeting set up yet. So, I don't take that particular complaint that seriously.

Mr. WALGREN. Well, we want to be immediately informed by you of any guidance that you are given by OMB in the user fee area or any agreement, let alone guidance that you might suggest be implemented. That is an area of very real interest to us.

Well, thank you very much on behalf of the Committee. We look forward to telling you what to do.

Mr. AMBLER. Okay.

Mr. WALGREN. The next panel is Dr. Mary Good, the President of Engineered Materials Research of the Allied Signal Corporation effort; Mr. John Lee, Past President of the National Conference of Standards Laboratories, who is currently with Telogy, Inc.; Dr. Russell Drew, President Elect of the Institute of Electrical and Electronics Engineers; and Nathan Hurt, Vice President of the General Engineering Group of the American Society of Mechanical Engineers.

We welcome you to the Committee and apologize for the time that has gone by. We appreciate your being a resource to us. In view of the fact that we will have two other witnesses after you, please take into account that our time is limited, if the others are to get a fair chance. We are very interested in your perspectives. Your written statements will be made part of the record. We would appreciate it if you would focus on those points that you really think might stick in our minds as we go forward in this process and deserve to be underscored and emphasized in this effort.

Let's then go in the order we called you. First, would be Dr. Good.

STATEMENTS OF DR. MARY L. GOOD, PRESIDENT, ENGINEERED MATERIALS RESEARCH, ALLIED-SIGNAL CORP.; JOHN LEE, PAST PRESIDENT, NATIONAL CONFERENCE OF STANDARDS LABS AND ON BEHALF OF TELOGY, INC.; RUSSELL DREW, PRESIDENT ELECT, INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS; AND NATHAN HURT, VICE PRESIDENT, GENERAL ENGINEERING GROUP, AMERICAN SOCIETY OF MECHANICAL ENGINEERS, INC.

Dr. GOOD. Thank you very much, Congressman Walgren. I appreciate very much the opportunity to be here today and in view of the time, I think what I will do is simply submit the written material for the record and what I would like to do then is to spend just a couple of minutes on some of the issues that I think are really very important in this budget and then I'd be happy to try to respond to questions, if that's reasonable.

I would like to emphasize that number one, there is no question that the National Bureau of Standards, I think, has been neglected over the last few years. I think that comes through in all the testimony you have heard today, and the basic kinds of things that the Bureau was set up to do in terms of measurement standards and so forth are really crucial to the long term health of American industry.

With respect to the specific things that you asked us to look at today, I've looked at the initiatives which they are asking to get into new areas. For example, the one on—let me speak to just one of those and then my comments will be relevant to the others. For example, the high performance composites area, which is new to the Bureau. My feeling is that this one is very much like the ceramics issue, which they have attempted to mount in the past. I have been on the Advisory Committee for the Advanced Materials Sector at the Bureau, and looking at those programs in detail, the biggest issue is that they are too small.

They in many cases are not—frankly, they are not a critical mass and it is very difficult for them to keep up with where the industry is going, and if we are going to have standards and measurements for these new emerging technologies, it doesn't help us very much if the Bureau gets those things done 10 years after the industry is long since beyond that point.

In many of these issues, that's been the case, not the fault of the Bureau, but the fault of the fact that they get into these new areas too late and with too little.

So, one of the issues I think is the questions which you already asked and that is how do you get into these new emerging technologies? It's absolutely essential that we have measurement technology for these issues.

Some of the other areas where I think some kinds of things are just absolutely imperative, the area, for example, which they are finally this year for the first time actually in the budget that got all the way through all of their hearings, have half a million dollars requested for their database composition.

My feeling is that database effort is way overdue. It's an area where everybody needs that information. We are still in many ways running engineering databases in the same way that we did

25 years ago. Much of that data is still on hard copy, done by private groups, which have the wherewithal perhaps to turn that data over and redo it about every 15 years in any particular area. It's just unusable. You talk about time. We need to be able to turn that kind of information much more quickly.

I think that whole issue of the database and particularly the certified data is perhaps one of the most urgent issues at the Bureau, and I'd like to see not only the half million of dollars that is requested here, I'd like to see significantly more than that, so that we can get that data up and on a modern system and out available for people to use.

The same is true in an area which hasn't been discussed yet today, and that's in the software standards, which is being done at the Bureau. This is an area which we really do have a position in the industry and the ability to get together and have common standards is one of the ways we can maintain a lead in this country, because if we can get ahead and set the standards, then our manufacturing ought to be able to get there with products that the public will buy quicker.

We've some real examples where the standards have just been abominable and whole industries are going down because we are now selling the wrong sized material. You can take—there's all kinds of issues like that.

So, let me just conclude and then like I say, I'd be happy to try to respond to questions. My feeling is that the programs that the Bureau have are utterly essential for our economic base and I'd like to see particularly in some of these areas significantly more effort even than what has been requested. I'm surely pleased to see at least an increase requested in the budget. I think it's absolutely overdue.

Thank you.

[The prepared statement of Dr. Good follows:]

TESTIMONY
OF
DR. MARY L. GOOD
BEFORE THE
U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON SCIENCE, RESEARCH & TECHNOLOGY
WASHINGTON, D.C.

MARCH 3, 1987

Dr. Mary L. Good
Ph.D, Inorganic Chemistry
University of Arkansas

President-Director of Research, Engineered Materials Research Division
Allied-Signal Corporation

President, American Chemical Society, 1987

Member, National Science Board
Vice-Chairman, 1984

Member, National Academy of Engineering

President, Inorganic Division of the International Union of
Pure and Applied Chemistry, 1981-1985

Louisiana State University, 1954-1980
Boyd Professor of Chemistry

Member and Past Member, various National Academy of Sciences and National Research Council Panels and Commissions; Member, boards of several institutes; Member, advisory panels for several universities; Authored more than 100 papers in refereed technical journals, several publications on science policy and research strategy, one book; Presented more than 200 invited lectures; Received numerous professional awards.

My name is Mary Good. I am president, Director of Research, of the Engineered Materials Research Division of the Allied-Signal Corp. Thank you very much for this opportunity to comment on the 1988 fiscal year budget for the National Bureau of Standards (NBS). I am here to testify this morning in support of the primary mission of the National Bureau of Standards - the establishment and certification of the standards of measurement which are the underpinnings of all U.S. industrial, academic, and governmental science. This Bureau's mission is vital to all segments of the industrial economy and takes on particular significance now as our country faces serious challenges in the international marketplace. The success of our current efforts to improve national competitiveness rests to a great extent on the success of the NBS in carrying out its historic mission.

The NBS has, since its inception, been basic to the success of our manufacturing-based industrial economy. However, some disconcerting trends have appeared over the last several years. The Bureau's budget and program have not kept step with the organization's role in commerce. Because of severe budget constraints, the Bureau's historic role has been inhibited and the kinds of efforts that have been most effective in the past are diluted. NBS is not just another national research lab and yet it has been funded as if it were through both direct budgeting and interdepartmental transfer. Research performed by the Bureau should always be focused on enhancing its mission, which involves the establishment of standards mandatory to the commerce of this nation and the world. For example, the proposed effort in Material Science and Engineering, particularly that concerned with Materials Characterization for High Performance Composites, moves away from the Bureau's traditional role. The following statement appears in the budget document on page NBS 29: "Specifically research will be conducted to establish relationships among constituent properties, microstructure, and composite properties. Process control sensors and models will be developed as a basis for improving both properties and reliable production. Composite performance will be elucidated by research relating failure modes, constituent properties, and microstructure." This kind of research is already well advanced in the industrial sector, and has been the focus of studies within the academic research community for some time. I feel strongly that the NBS focus (and this is only one example among many within the proposed NBS program) should be on research leading to the application of state-of-the-art technology to the characterization, measurement and ultimately, development of standards for emerging technologies. Research to create standardized tests for materials failure analysis would be appropriate and requires first-class scientific expertise. I realize that reliable standards cannot be set without an understanding of the fundamentals of materials failure, but NBS does not have the resources to create that basic knowledge.

In addition, NBS should focus its resources on generic problems. Within that sphere, priority should be given to the interface of standards with commercial development in the area of quality control. The Bureau's programs to determine thermodynamic properties, phase diagrams, and other generic data for materials are outstanding. A continuation of these programs is essential for the achievement of our national research and development goals.

The Bureau's Measurement Research and Standards program includes an element titled Measurement Technology Transfer which provides for the Standard Reference Data and Standard Reference Materials programs. These operations produce, certify and issue samples of materials of precisely known characteristics. This effort is absolutely necessary for effective research and development. Along with the Computerized Reference Data program these programs are the prime reason for having a "Bureau of Standards."

Of particular interest to me as a scientist is the postdoctoral fellowship program contained within the Research Support Activities element of the Bureau's budget. This program will provide an opportunity for outstanding young scientists and engineers to assist in the creation of certified standards and measurement techniques. Such experience will serve them well in their future research efforts. The creation of a cadre of scientists with the capability to apply fully the information offered by the National Bureau of Standards will greatly enhance the effectiveness of our governmental and industrial laboratories as well as assist in the rapid application of academic research by the industrial community. In addition, the fellowship program is the most cost-effective way to assure the Bureau of a continuous stream of new ideas and new thrusts without adding excessive head count.

The Technical Competence Program is a subprogram of the Research Support Activities. The need for the National Bureau of Standards to build a leadership position at the cutting edge of science and emerging technologies in Measurement Science is absolutely essential.

The accumulation, consolidation, and certification of the wealth of experimental data that exists in a variety of sometimes obscure publications is vital to the advancement of all research and development, including the Materials-By-Design effort. Today, each potential user must revalidate these data prior to use. The savings in time and talent that could be made with certified data is enormous. NBS has proposed such a project under the Computerized Reference Data program, for which a budget increase has been requested. I quote, "Scientists and engineers need rapid access to reliable data on characteristic properties, materials, chemical reactions, etc., as part of their daily work." As the NBS document also states, the U.S. labor force expends 10% of its efforts on activities which involve finding or creating the information necessary to pursue a specific research or development effort. I fully support increased funding for this program to expand the tools available to researchers and I strongly recommend that this program receive major emphasis as part of the basic mission of NBS. One measure of the value of this program is the NSF support for this activity. The National Science Foundation Act of 1950 specifically authorized and directed the Foundation (42U.S.C.1862) "to foster the interchange of scientific and engineering information among scientists and engineers for study and research in the sciences or in engineering." From 1980 through 1987, NSF transferred $250,000 annually to the National Bureau of Standards. The money was earmarked for projects that provide reference data in a number of research areas supported by the Foundation. After several of the NSF's research arms evaluated this activity in 1986, funding was increased to a total of $425,000 per year for an additional three-year period. The Foundation's Division of Chemistry, the Division of Materials Research, and the Directorate for Engineering bodies jointly supported the increase. An interdisciplinary group is being established within the Foundation to help the NBS select projects that are most relevant to NSF activities. This funding adds to the "Certified Data" effort and helps to assure the quick response of science and technology where it is imperative that we not "re-invent the wheel."

The Process Control and Quality Assurance program outlined by NBS represents an area which must be aggressively pursued if our nation is to continue to build up its R&D and international competitiveness. The proposal to develop a stored ion source as a next generation atomic clock and frequency standard along with new standards for pressure and voltage measurements seems most appropriate for the NBS.

The proposed Lightwave Measurement Technology program, which features fiber optics research, should focus on establishing standards that allow the fiber optics products made by various manufacturers to be interfaced with one another. This would expand our nation's capability to apply this already commercial technology. The budget describes, on page NBS 36, a research and development program to provide a generic technology for the expansion of fiber optics applications. Programs of this sort are already well advanced in the industrial sector. But we sorely need interface standards for this technology and NBS research directed at such standards is highly appropriate.

The Automated Manufacturing Research Facility is an examplary NBS program. This facility provides a service consistent with the Bureau's mission. It establishes interface standards for the equipment in the factory of the future. Further work in this area should be pursued aggressively but always with the focus on establishing interface standards rather than on the dynamics of the machines themselves. NBS must avoid duplicating the already far advanced efforts of U.S. industry.

Another outstanding NBS program within the Engineering Measurements and Standards element is research and development in Fire and Building Safety. No other organization is doing work of this quality in this area. Fire and building safety requirements and ordinances to assure the safety of our people historically have been the prerogative of local municipal codes. However, the municipalities writing these codes do not have the facilities or funds necessary to establish modern and appropriate standards to achieve the required level of safety at minimum cost to the public. Research efforts in toxicity studies, fire modeling, and materials behavior should be pursued aggressively, and should be expanded with increased funding.

As proposed, consolidation of the centers for fire research and building technology represent an opportunity for improved efficiency, but reducing the budget of this most important program is not appropriate. It is my feeling that the money saved by this consolidation should be applied to expanding the program areas to enhance our ability to provide suitable and safe housing for our people. Sizeable cost reduction can be made in the construction of most buildings and residences if the building codes involved with electricity, plumbing, sewerage, and structures were better standardized across the nation. This NBS program should lead to the establishment of acceptable minimum levels which could be relied upon by the various municipal and state licensing organizations to assure that buildings are neither overdesigned nor underdesigned. As a result, the labor necessary to construct them and the cost of materials will be maintained at minimum levels to provide the maximum amount of shelter at minimum cost.

I bring to your attention the Chemical Engineering Metrology Program that appears under the Engineering Research and Standards element. In this program, NBS has historically done outstanding work in providing the measurement techniques, standards, key properties, data, and predictive methods that enable the chemical and related industries to calibrate their measurements relative to national standards. Need in this area is great. The budget request should focus on the kinds of things that NBS has done so successfully in the past. I think that expansion into areas such as research support for the use of new feedstocks derived from crude oil are probably inappropriate and can be done better by other agencies.

The Bureau's small budget for the Handicapped Activities program should be focused on two programs: fire research and setting standards for required materials. The research effort in prosthetic devices and the like would be better pursued by the National Institutes of Health with coordination and support from the National Bureau of Standards rather than as a free-standing program at NBS. The Fire Research area, as it affects handicapped persons, is appropriate for study by NBS as it is the handicapped who generally suffer most from the ignition and spread of fire and toxic gases within buildings.

At the heart of my comments today is the belief that NBS must have scientific expertise to drive its programs towards its primary goals: establishing standards for measurement and materials characteristics. The Bureau's focus should be on understanding the current and future standardization needs of industry and the measurement sciences. U.S. industry is fully capable of carrying out efficient research and development to establish new products, process techniques or methods, but we cannot do this without standards.

Philosophically, the NBS is at a crossroads. The road it chooses will make a difference in our nation's ability to compete in world markets. The Bureau's basic programs in fundamental science are absolutely essential to our science and technology. I suggest strongly that the NBS continue to do what it does best: carry out its mission to establish standards and techniques of measurement, and develop interface standards and measurement techniques in support of the industrial, scientific, and academic efforts of this nation. Thank you.

Mr. Walgren. Thank you, Dr. Good. Mr. Lee.

Mr. Lee. Mr. Chairman, the National Conference of Standards Laboratories is an international organization and I would like to point out that we are here speaking for the domestic industrial segment of that organization. We'd like to thank you for the opportunity of being here. It's a pleasure to be here. It's nice for someone to listen to us.

I'm currently the Government Affairs Committee Chairman for the NCSL and a past president. I have with me as my colleague, Mr. Pete England, who is also a past president of the NCSL.

Last year, we thought we found $1 million to help the process control and quality assurance project but we found that didn't make it all the way through, but we thank you for that effort and that gives us hope, but we thank you for that effort last year.

Mr. Chairman, we're concerned. We cannot meet the needs of our organization because the NBS cannot provide the required services for us. Lack of adequate funding is not the only reason but it's a big part. The Bureau continues to take on new roles that are not the delivery of measurement services and with no additional funds to do that. Funds are converted to other areas. These all make a bad situation worse.

We believe that the parties involved either do not understand, do not care or are unwilling to make the difficult necessary decisions. We feel that the Bureau has lost sight of their original purpose, the delivery of measurement services. We believe that strong direction must be provided that will return the Bureau to that original purpose.

We believe that the Bureau is not held accountable for performance, schedule and costs. We believe their accounting system is not credible. We feel we need to explain some meaning here. We are referring to the methods of priority assignment, specific program accountability, and the measurement of cost versus revenue. We are not referring to the basic software, if you will, accounting system. We are sure that's state-of-the-art and very current.

They cannot obtain adequate funds and we seem to have a problem managing the funds that they do get. We wonder why we have all allowed this to happen and to continue. We are concerned.

In the FY 1988 budget, there are two primary areas of concern to the NCSL, the process control and quality assurance element of $3.55 million is not nearly enough, but we are compelled to endorse it and the listed projects, but it's not nearly enough.

Light wave measurement technology, $500,000, and we already heard this morning that original request was for $10 million. It's not sufficient, but once again, we are compelled to support that because it is something.

Leverage is a new word—not a new word but an important word that surfaces a lot lately. The Bureau does this well when they are able to deliver but when they cannot or do not, we have a form of reverse leverage. For example, in those emerging technology areas where adequate national traceable standards do not exist, then industry must over design and over test and all of these things create significant additional costs.

The private sector; we've had a lot of discussion lately and today about the possibility of industry developing a more active role in the development of standards, to save Federal dollars. This sounds good, but it's really counterproductive. We have legal problems. We have a hard time getting together and sitting down and talking. That's construed in some areas as a legal problem for us. There's legal problems with the final product. Whose is it, is it mine, is it his company, is it his company? How do we share them?

There's a question of perceived integrity, if my company designs it and invents it, will that be accepted by the rest of the industry blindly? We are not a competitively neutral industry and God bless the Bureau, they are competitively neutral and that is one of the most significant things through everything that we talk about, that competitive neutrality allows all of the things that the Bureau designs and the various standards that they come up with to be processed through our industry, and if we in industry come up with various standards, there is doubtful international acceptance of that. It must come from the Bureau. It's their job and they need to do it.

Everyone benefits from the service but no one benefits enough to see that the work gets done. The public investment in Federal science and technology should yield maximum public benefit and this will come through the National Bureau of Standards.

In 1987, in the authorization bill, the NBS Director was directed to hold various discussions with both the Federal and private sector agencies. We've been asked to comment on that. We, the NCSL, have not been asked yet to participate in that. The NCSL leadership, our leadership, has been surveyed and they indicate no request of their organizations. We really believe that it may be a bit early. This hasn't been out very long. We do have our annual meeting with the NBS Director and his staff, later this month, and I'm sure that will be a discussion item.

We are aware of a special joint meeting between the Director and TRW, Lockheed, Hewlett-Packard, and Hughes later this month on the millimeter wave and microwave areas. That's been in the process for some time.

We feel this is a very good program of the Director and his staff, interfacing, interacting, with industry and we think that should continue.

In conclusion, Mr. Chairman, the situation and the measurements standards and calibration services portion of the Bureau's mission has become so serious as to impede the orderly process in national productivity and quality control and to impact this nation's defense programs. We believe this mission underpins every aspect of the American economy. It needs to be given a renewed direction.

Accordingly, we recommend that the Congress direct the following actions; early completion by the NBS Director of last year's legislative mandate to determine the need for services and the means for funding them; an independent assessment and subsequent overhaul of the NBS performance, schedule-and cost accountability system, a management review, if you will, that looks at the priorities, objectives and accomplishments; a re-focus on the primary mission of the National Bureau of Standards' measurement standards and calibration services at all NBS management levels, and at the Department of Commerce.

A report by the NBS Director on the results of the above items and the implications for future legislative action relative to the future roles and missions of the NBS.

We believe the funding issue is at least as important, we urge you to carefully examine this budget and particularly the $3.55 million for process and quality control, to determine whether their proposed amount is really sufficient to carry out the measurement standards and calibration services mission. We believe that you will conclude that it is not sufficient. We, therefore, strongly urge that the NBS budget for this mission be increased to the level necessary to meet all requirements.

This would require not only the actions proposed in our report but also an absolute increase in the process and quality control initiative of $22 million.

Thank you very much for the opportunity.

[The prepared statement of Mr. Lee follows:]

STATEMENT

OF

JOHN LEE, PAST PRESIDENT
THE NATIONAL CONFERENCE OF STANDARDS LABORATORIES

BEFORE

THE SUBCOMMITTEE ON SCIENCE, RESEARCH, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

ON THE

NATIONAL BUREAU OF STANDARDS
FY 1988 BUDGET

MARCH 03, 1987

Mr. Chairman and Members of the Subcommittee, I am pleased to have the opportunity today to discuss with you the concerns of the domestic industrial membership of the National Conference of Standards Laboratories and more specifically, our views relative to the FY 88 NBS budget proposal.

My name is John Lee. I am a former President of the NCSL and am currently serving that organization as its Government Affairs Chairman. I am also Vice President - Operations at Telogy, Inc., located in California.

Our organization has been privileged to appear before this Subcommittee on several occasions over the past few years during the NBS budgetary hearings. We also provided our written and in-person statements in October 1985 when this Subcommittee was holding hearings on the future role and missions of the Bureau. Again, we certainly appreciate these opportunities to express the views of the U.S. measurement community, and, speaking on behalf of that concerned body, we thank you.

Just prior to last year's NBS budgetary hearings we learned that no carry-on funding was included in the Administration's FY 87 budget for the Bureau's Process and Quality Control initiative. Our organization was certainly pleased to hear that this Subcommittee - in response to our pleas as well as those from other concerned parties - recommended the inclusion of $1.0 million to help remedy some of the acute problems facing the U.S. National Measurement System. We fully understand now -

as we did then - that this is a most difficult time for funding initiatives. Although we applauded your recommendation, we were disappointed when we heard that the restoration efforts did not prevail. We commend you and your staff for your insight and understanding of this country's critical measurement science needs.

SUMMARY OF CONCERNS AND PROBLEMS

The National Conference of Standards Laboratories domestic industrial membership continues to be concerned about the delivery of measurement and calibration services by the National Bureau of Standards. As we have stated before this Subcommittee in the past, many of us are unable to meet the measurement and calibration needs of our parent organizations because the National Bureau of Standards has been unable to provide us with vital measurement standards and calibration services. This concern - and the problems they represent - are certainly not new. However, as each year goes by with only token efforts made to halt the decline in this vital and primary function of the Bureau, our concern is heightened and the problems have become more acute. The problems we see are not just caused by a lack of funding but we believe it is fair to say they have their genesis in the federal budget.

The budget has remained essentially flat in constant dollars for many years. During this period the Bureau has taken on a number of new or greatly expanded roles (some by its own choice, others mandated by

Congress or the Department of Commerce). Not many of these new roles were aimed at the delivery of measurement and calibration services. Inevitably, therefore, that part of the NBS budget devoted to the research and development of measurement standards and the delivery of calibration and measurement services has declined in constant dollars.

Even when funding is appropriated for this sector, we see much of it siphoned off to be used - mostly - to fund other sectors not related to the delivery of measurement and calibration services. This trend exacerbates the already difficult situation and must be reversed!

The above factors lead us to the inescapable conclusion that the parties involved either do not understand the seriousness of the situation, do not care about it, or are unwilling to make the difficult decisions necessary to correct it.

It is our view that the NBS has apparently lost sight of the original purpose in creating the Bureau in 1901 - specifically the standardizing role provided through the delivery of measurement and calibration services. Therefore, strong direction must be provided that will return the Bureau to that original purpose.

It is our view that the NBS is not held accountable for the execution of its several responsibilities - either as to performance, schedule, or cost. It is our perception (not based on a systematic audit) that the NBS financial accounting system cannot (with any degree of credibility) provide traceability between work performed, results obtained and costs incurred. This condition makes it impossible to develop a credible scheme for amortizing research costs for measurement or calibration services over future sales of the developed service which many believe is the only way that these costs can be fairly recovered. We believe it is essential that a more traceable and auditable financial accounting system be implemented at the NBS at the earliest possible date. (Other agencies of the government, such as DoD, utilize specifications which define in exquisite detail the features of a system for managing performance, schedule, and cost of projects which might be useful in this regard.)

It is interesting to note that the Organic Act permits the NBS to strategically establish fee structures that are not necessarily intended to recover the full costs of the services; in fact, fees lower than costs were suggested in order to attract more users (then considered essential for commerce and trade). Today (on average) the NBS fees for calibration and measurement services are higher than fees of any other standards laboratory in the world.

The current thrust within the Bureau is to recover development costs for these services. The method used - demonstrating vividly the inadequacy of the financial accounting system - is that of a blunderbuss. Services developed years ago, together with more current services, have all seen significant fee increases. There appears to be no relationship to the development cost - or when it occurred - and the fee increase proposed. In other words it appears that the increases are arbitrary and not intended to recover development costs, but rather intended to generate another fund pool for the Bureau.

CONTRIBUTING FACTORS

In examining the various factors that contribute to the Bureau's present plight, it is clear that their inability to obtain adequate congressional funding, and when received, to effectively manage that resource are major determinants. As cited in the past, The Bureau's congressionally funded budgets for measurement standards and calibration services have remained essentially flat over the past two decades in constant 1965 dollars. This has occurred during a period of unprecedented advances in science, technology, and manufacturing, and more recently, during a time when the stated objectives of the current Administration include increased international competitiveness and the stimulation of productivity, economic recovery, and growth! Why have we permitted this ongoing enfeebling of what many of us believe to be the primary mission of the National Bureau of Standards?

First it is important to understand that the Bureau - like most industrial companies - has two distinct internal cultural factions. The first is the science faction (basic research) that normally receives high corporate, public, and political visibility and the second is the engineering faction which attempts to focus its efforts on the application of that scientific research data and technology for the benefit of the customer or the user. What we find is that the latter faction must often compete with the former for adequate funding. It is however, the latter engineering faction that transfers the technology for the betterment of our economy and the American public. I want to emphasize that it is important to be aware of this imbalance in public and political visibility as you deliberate NBS funding requirements. For example, this same visibility imbalance has probably contributed - in no small way - to the perception that the Bureau has developed into a National Job Shop. It appears to many of us in the measurement science field that this country has lost sight of the original purpose for the creation of the Bureau: Namely, the support of U.S. industry's measurement and standards needs.

We do not imply by this discussion that the science faction is unimportant. In fact it is vital to the ability of the NBS to remain at the forefront of scientific endeavor. Only in this way can it create the knowledge upon which subsequent technology advances in the measurement and calibration areas may be based. We do mean to emphasize that the apparent invisibility of the engineering faction (specifically the measurement standards and calibration functions) in no way makes it less important than its more visible counterpart.

American industry's measurement and standards needs are well documented and published and have been extensively reviewed not only by the Bureau, but by others as well. I need not belabor this Subcommittee with all the details of these surveys and studies today. It is perhaps sufficient to say that you - as well as the Bureau - are aware of these ever-growing industrial measurement concerns and the importance that measurement standards and calibration services play in America's overall industrial quality scenario.

The Bureau appeared not only to recognize these national measurement short falls (as the Department of Commerce Deputy Secretary, Clarence Brown, testified before this same Subcommittee 15 months ago), but was developing three separate FY 87 initiatives of importance to the science and calibration community. The three Bureau initiatives included:

- $6.1 million for Process and Quality Control
- $6.3 million for Millimeter and Microwave Standards and Calibration
- $10.0 million for Fiber Optics and Electro-Optical

Unfortunately most were left on the cutting room floor. In light of this Administration's stated objectives of increasing our Nation's international competitiveness and the stimulation of productivity, economic recovery, and growth, it appears incredible that the same segment of our government could then ignore the direct relationship between national measurement standards and the achievement of such industrial growth objectives. The U.S. National Measurement System consists of several thousand organizations, laboratories, and institutions all linked together, both voluntarily and by regulation.

The system is absolutely dependent upon traceable linkage to a technically competent, credible, and competitively neutral National Bureau of Standards. As can be appreciated, this same National Measurement System is an integral part of every element of the U.S. economy. It underpins all of our scientific, medical, and industrial endeavors and provides for:

- Equity in trade and commerce (both here and abroad)
- Product quality and industrial productivity
- Universality or equivalency in engineering and production methods
- Progress in science and technology
- Health and safety of all Americans
- And lastly, the security of the Nation

It seems imperative therefore - now as well as in the foreseeable future - that national measurement standards must always be a conscious element of this Nation's industrial growth policy. To believe otherwise is folly.

FY 88 BUREAU FUNDING ISSUES

We have before us today a budget for the National Bureau of Standards that includes two primary initiatives of interest to the membership of the NCSL.

1. Process Control and Quality Assurance

This initiative includes the following prioritized projects:

		($ x 1,000)
1)	Primary Frequency Standard R&D	438
2)	High-pressure Measurements	305
3)	AC & DC Voltage	441
4)	Radon Measurements	246
5)	High-temperature Thermometry	174
6)	Low-frequency Measurements	967
7)	Electrical Documentation & Training	255
8)	Neutron Dosimetry	246
9)	Electrical Resistance Measurements	306
10)	Primary Temperature Facility	172
	TOTAL	$3,550

Although we believe that the budgeted base funding for measurement and calibration services is too low all across the board and although it is clear the $3.55M for this initiative falls far short of identified national needs we are compelled to endorse this token amount. We would urge this Subcommittee to seriously consider all of the needs and to provide the additional funds which would contribute more substantially to halting the unfavorable and damaging trend previously noted. We believe that it is imperative that the initiative be fully supported throughout the entire legislative process. In the past several years, it has been amply documented that U.S. industry has come to recognize not only the importance of implementing new process and quality control methods and techniques during manufacturing, but also, to begin to recognize the equally important relationship that standards and accurate measurements have in that total quality scenario. Industry's renewed quest for quality and increased productivity in response to intense foreign competition is - and will be - heavily dependent upon the Bureau's planned capability recovery in these high priority areas.

2. Lightwave Measurements Technology - Fiber Optics

Our organization also endorses the Bureau's budget item of $500,000 to provide measurement technology and services in support of the optical fiber communication industry although we question whether that amount is sufficient. The economic advantages of this emerging industrial technology over the more traditional hard wire communication systems makes this an attractive industry for the U.S. government to promote and stimulate. The Bureau's proposal to develop data, measurement methods, and standards for defining component performance as well as characterizing the materials from which these components are made will enhance the U.S. lightwave technology industries' competitive position in the international marketplace. Failure to seize this opportunity now will lead to another disaster in the future similar to our current position in millimeter wave measurement standards technology. Accordingly, the NCSL organization endorses this FY 88 Bureau budget initiative.

LEVERAGING THE U.S. ECONOMY

We believe one of the Bureau's primary contributions to the U.S. economy is to leverage the productivity and the quality of industry's technology-based activity. A very important example of how this type of leverage works in reverse (lack of government lab involvement) can be cited in those emerging technology areas where adequate national traceable standards often do not exist. Industry must, therefore, substantially over-design and over-test its products in an effort to assure performance specifications. This added cost burden inhibits further our competitive position as well as our ability to penetrate both domestic and international markets. On the other hand the previously mentioned Bureau initiative on Lightwave Measurement Technology can be used as a positive example of how Federal funding of a government institution has provided - and will continue to provide - effective leverage. Since private sector measurement research and development technology is generally narrowly focused, it is therefore usually narrowly applied; whereas, if it's done by the Bureau it can be applied across several industries.

The lightwave technology industry and fiber optic area has already benefited from ongoing research at the Bureau in laser metrology, and we understand they are also interfacing now with cryoelectronic metrology. As can be seen, the benefits resulting from this proximity of resources and shared talent can only be achieved because of a centralized development institution such as the Bureau. And of course, the diffusion and the dissemination of that technology and that research information back to U.S. industry is likewise broader and also more rapid. Private sector developed measurement technologies are frequently classified proprietary and to the extent that measurement technologies are only useful if adopted by an entire industry in the form of a standard; limited, or slowed release and diffusion is certainly not beneficial to the overall national economy.

NBS VERSUS PRIVATE SECTOR

In the recent past, some have suggested that the private sector - primarily U.S. industry - should play a more active role in the research and development of measurement standards in support of our technology-based economy. It is assumed that the principle driver behind such policy suggestions is an effort to reduce the federal outlay and hence improve the national deficit picture. Although on the surface such a policy may appear to have some merit, the general application of such a policy to the only Federal agency dedicated to facilitating the use of technology for national economic benefits, rather than for advancement of a specific mission, is counter-productive.

An "active role" is usually interpreted to mean some form of financial contribution, an investment, in the enterprise. We believe the most effective and fairest way to carry out the objective would be for Congress to appropriate the funding and to find a way to amortize these research and development costs over the expected life of future sales of the service. This would require beneficiaries of the service to pay - but, in a way that would be fair and equitable. Unfortunately, the present accounting system at the Bureau appears incapable of credibly collecting and reporting real costs today much less being able to fairly apportion development costs of a service to future fees.

It is imperative that your Subcommittee consider - in depth - the economic benefits which accrue from investments in the Bureau. As stated earlier, national measurement standards must always be a conscious element of this Nation's industrial growth policy. We strongly advocate the government's role in supporting measurement standards for U.S. industry and submit the following comments and observations in regard to privatizing this vital function:

When a few U.S. businesses do develop industry-wide measurement technologies and consensus standards, they rarely have the required credibility with other marketplace participants since they were not developed by an institution perceived to be technically competent or at least competitively neutral. Only an institution such as the National Bureau of Standards can effectively act as a neutral third party when there are marketplace disputes.

We would also cite the many National Bureau of Standards' formal measurement reciprocity agreements with other countries' national standardizing labs. Such agreements are entered into in an effort to reduce non-tariff trade barriers and enhance international competitiveness in the marketplace. It is extremely doubtful - if we had a private sector scheme in this country - whether other countries could (or would) actually enter into such agreements with either institutions, private companies, or associations.

We also recognize that there are other aspects of this issue of a more active role for industry including legal aspects, earmarked donations by companies to the NBS, etc. This topic should be more fully discussed when the NBS Director meets with industry's leaders.

In summary of this issue, we also observe that virtually all industrialized countries have strong government-supported and subsidized standards institutions. The NCSL organization believes it is absolutely essential that this country also have in place a federally supported - and adequately funded - national standards laboratory which is not only recognized as a credible institution, but also one that is competitively neutral. We believe it is equally important that this country has a cohesive and coherent National Measurement System made up of private sector laboratories whose actions and procedures can be guided by - and referenced to - that federal facility. As a Nation, we cannot permit - nor can we afford - any erosion of public confidence in the U.S. National Measurement System. This will most assuredly result if our government pursues a policy of forcing private sector involvement in the development of national measurement standards.

BUREAU OUTREACH ACTIVITY

The NBS was created in 1901 for mostly economic purposes and remains today the only Federal laboratory whose mission is to serve the needs of American industry. Even though industry is the primary user of NBS services, the Bureau is authorized to perform its functions for many other "customers". Included in this category are: the U.S. Government; international organizations, governments of friendly countries, State or municipal governments in the U.S.; scientific societies, educational institutions, firms, corporations, or even individuals.

The rationale for developing any National Standardizing Laboratory (NBS included) is based upon a basic economic imperfection: Everyone benefits from its services, but no one benefits enough to see that the work gets done. When U.S. Industry identifies the need for national measurement standards and technology it becomes incumbent on the Federal government to establish that mission and then authorize and appropriate the necessary funds to accomplish that mission. The NCSL organization firmly believes that philosophy, that purpose, and that premise were in the minds of the creators of the Organic Act at the turn of the century and are just as equally important and relevant today. For instance, today's National Science Policy is based on the premise that the public investment in federal science and technology should yield maximum public benefit. The President's Science Advisor, the Panel of the White House Science Council on Federal Laboratories, and the Congress have all emphasized in the past the importance of cooperation between the national laboratories and the potential users of federal science and technology. In particular, the 1980 Stevenson-Wydler Technology Innovation Act calls for improved communications to stimulate such cooperation.

The NCSL is also aware of the specific Congressional direction given to Commerce and the Bureau in last year's Authorization Legislation. We support Congress re-emphasizing the need for the Bureau to establish and maintain a systematic and vigorous outreach program to the Nation's technological infrastructure. We have been asked to comment on the progress relative to last year's Legislative mandate for the NBS Director to discuss with other agencies, industry, and professional associations the subject of demand for calibration services and the Process and Quality Control initiative and their funding. Although it is perhaps too early to expect any significant progress, we can state that we have not been formally requested to discuss this subject with the Director. (It could very well be a topic at an Executive meeting with NBS management later this month, however.) An informal poll of the NCSL leadership disclosed no official communication from the NBS Director to their respective companies on this subject.

To continue on a more narrowly focused issue, the Director of the Bureau, Dr. Ambler, has scheduled a meeting this month with top Industry Executives from TRW, Hewlett Packard, Hughes, and Lockheed. The meeting is to address these companies' concerns about the Bureau's inability to support selected contractually required measurement traceability requirements in the millimeter and microwave areas. We understand the Bureau is planning more such meetings with top-level management executives from other U.S. industries to pursue similar measurement requirement issues. The NCSL organization is certainly encouraged and fully supports such high-level executive dialogue between the Bureau and our member companies. It is premature for us to comment on the outcome of these planned meetings, but our organization can certainly speculate that such direct interactions will - as a minimum - result in a higher level awareness of the critical nature of U.S. industry's measurement science needs.

To fulfill its mandated mission, the NBS has - over the years - established a host of linkages with U.S. industry, the academic communities, professional and trade association, and with other agencies of the government including state and local as well as the Federal level.

More specifically, these Bureau-Industry relationships and interface activities are maintained for delivering its products and services and for assessing the evolving needs of U.S. industry. To comment further - and again more specifically - about their past outreach efforts to this nation's measurement science community, we would rate their involvement with the NCSL between good and excellent.

The NCSL represents over 700 domestic member laboratories, and although we are now an independent organization, we still maintain one permanent voting member from the Bureau on our Board of Directors. The Bureau actively attends our annual Conference and Symposium both as program participants and interested attendees. The NCSL holds approximately 20 Regional meetings throughout the country each year with special agenda workshops which are designed to permit local membership to interface directly with Bureau representatives about national measurement requirements. The NCSL Executive Committee also meets with the Director of the Bureau and his key staff members during the first quarter of each calendar year to discuss issues of mutual interests. U.S. industry's measurement requirements are always agenda topics for these executive meetings. Through these interactions we make our needs known as well as by provisions of special study reports to the Bureau.

CONCLUSIONS AND RECOMMENDATIONS

Mr. Chairman and Members of the Subcommittee, the situation in the measurement standards and calibration services portion of the Bureau's mission has become so serious as to impede the orderly progress in national productivity and quality control and to impact this nation's defense programs. We believe this mission underpins every aspect of the American economy; it needs to be given a renewed direction.

Accordingly, we recommend that Congress direct the following actions:

1. An early completion by the NBS Director of last year's Legislative mandate to determine the demand for services and the means for funding them;

2. An independent assessment and subsequent overhaul of the NBS performance, schedule, and cost accountability system;

3. A re-focus on the primary mission of the NBS measurement standards and calibration services at all NBS management levels and at the Department of Commerce;

4. A report by the NBS Director on the results of the above items and the implications for future Legislative actions relative to the future roles and missions of the NBS.

As we believe that the funding issue is at least as important, we urge you to carefully examine this budget - and in particular the $3.55M Process and Quality Control initiative - to determine whether the proposed amount is really sufficient to carry out the measurement standards and calibration services mission. We believe you will conclude that it is not. We, therefore, strongly urge that the NBS budget for this mission be increased to the level necessary to meet all requirements. This would require not only the actions proposed above but also an absolute increase in the Process and Quality Control initiative of $22M.

Thank you for the opportunity to express these concerns. I'd be pleased to answer any questions you might have.

Mr. WALGREN. Thank you, Mr. Lee. We appreciate that. Mr. Drew?

Dr. DREW. Thank you, Mr. Chairman.

I am appearing here on behalf of the Institute of Electrical and Electronics Engineers, the world's largest technical professional society, as their President Elect. I would also add, however, that the statement that is entered into the record has been endorsed by the American Association of Engineering Societies and therefore represents the views of a large fraction of the engineers in the United States.

As you probably will recall, it has been my privilege to appear before this Committee in that guise, representing the IEEE in numerous previous occasions, and in none of those occasions have I felt the sense of urgency and the need for action as I do today.

In brief, I want to try to leave one message, if I can, and that is it is time for a change. It is time for a change in the way the Administration approaches the budgeting and the programs that are assigned and supported at the Bureau. It's time for the Congress to take much more vigorous action in supporting increases in the budget to support those programs that have accumulated in the Bureau and which you have heard a great deal about this morning.

It is time for the public and industry to give more prominence to the importance of the standard setting role and the coordinating role in many areas that the Bureau can and should play.

Today's headlines, headlines in the paper today about non-financial productivity at a standstill last year, illustrate the importance of the problem, the issues that we face as a nation today, to which the Bureau of Standards can make a significant and real contribution.

It's in that context then that I want to emphasize a few major points about the NBS program. First of all, we'd like to see a commitment to an increase at least to the $200 million level for the budget for the Bureau of Standards. Now, I spent 11 years on the other end of Pennsylvania Avenue in the White House, in the Office of the President's Science Advisor. I dealt with the OMB and I know their philosophy and their attitude, so we don't offer that type of recommendation lightly. We really believe there are specific program initiatives that can fit within that $200 million level and the target should not just stop there, but that's our first order target within the next three to five years.

Let me highlight a few of the specifics which I believe support that recommendation. First of all, we'd like to encourage aggressive pursuit of the demonstration personnel management program. It was mentioned earlier by NBS personnel that they are going to start this program later in the year and they don't see any need for additional funds to support that program. I think we would like to respectfully disagree with that. One of the concerns that employees of the Bureau may have about such management programs is that there are winners and then there are losers in such incentive programs, if you constrain them to live within a constant budget. For everyone that is going to be increased, somebody is not going to get an increase or there may be promotions not made, hirings not at the right level.

This is not necessarily a zero sum game. It should be recognized that these NBS employees are very rare individuals. They need to be the best that we can supply. We need to have the incentive program that this flexible personnel management concept provides but it needs to have a modest increment of funding to support it.

Secondly, the Institute of Computer Science and Technology, very much like the Fire and Building Institutes, seem to be under continual attack from OMB. We can't understand it. We can't really see how they can be quite so narrow minded in their approach to an extremely important coordinating and supportive role by the NBS for things such as protocols for network standards, computer security and so on.

We believe that the computer science and technology programs in the Bureau should be at least maintained at the $10 million level plus an increment for inflation and that their program should continue to expand beyond that. At least the first step is to raise it to the $10 million level this year; this step should be taken.

Finally, let me talk to the standards aspects. I think we would tend to support very strongly the need for the recognition—revitalization of the basic mission, that is the fundamental standards delivery programs of the Bureau. We believe that in the electrical and electronics fields, there are numerous opportunities, light wave technology, that's just one of them, that are extremely under funded. We see that of all the areas in the Bureau that should receive funding, this standards role should be the first. We believe that there is adequate opportunity to see a $25 million increase in this area alone.

Now, these recommendations sound like we are asking for more and more and more and in a sense, Mr. Chairman, we are, but it's a recognition that this is a vital program to the economic security of the United States.

Now, as part of that, I think the Bureau can play an important philosophical role and I would like to mention it particularly in the context of your bill, H.R. 812. We support that bill. We support its objectives and we support the role of the Bureau in emphasizing the importance of quality control as part of an integrated strategy that we have to adopt in the U.S. in dealing with industrial productivity improvements.

This is the tip of an iceberg but it's part of what we see from the IEEE standpoint as a very, very important need in the country today.

Finally, I would like to ask in connection with the human resources aspect, which I think fundamentally is behind the strength of the Bureau, which they have to base their future role on, to allow me to enter a position paper on engineering research and development in the United States, which the IEEE has endorsed and which we commend to your attention in connection with that human resource and the importance of engineering.

Dr. Drew. Thank you very much.

[The prepared statement of Dr. Drew follows:]

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STATEMENT

BY

DR. RUSSELL C. DREW

On Behalf of the

ENGINEERING R&D COMMITTEE

of the

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

on

NATIONAL REQUIREMENTS FOR COMPUTER STANDARDS AND PRODUCT MEASUREMENT STANDARDS AND THEIR RELATIONSHIP TO THE NATIONAL BUREAU OF STANDARDS

before the

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
HOUSE SCIENCE, SPACE AND TECHNOLOGY COMMITTEE

March 3, 1987

STATEMENT OF DR. RUSSELL C. DREW
ON BEHALF OF THE IEEE ENGINEERING R&D COMMITTEE ON NATIONAL REQUIREMENTS FOR COMPUTER STANDARDS AND PRODUCT MEASUREMENT STANDARDS AND THEIR RELATIONSHIP TO THE NATIONAL BUREAU OF STANDARDS

before the
House Science, Space and Technology Committee
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As the largest technical professional society in the world, the IEEE has a very special interest in the vigorous growth of technology and its productive application to serve people's needs both here and abroad. Our 228,000 members in the United States are engaged in advancing the frontiers of knowledge across a broad range of important and fast growing technologies that are vital to our national industrial competitiveness and our defense systems. We are, therefore, particularly interested in Government programs that support those efforts.

In this regard, we wish to address the elements of the proposed Federal Budget that affect programs of the National Bureau of Standards in computer science and technology, such as specifications and conformance standards, and on product measurement science, such as precision measurement standards for electrical, electronic, microwave, millimeter wave, fiber optic and optical electronics.

The National Bureau of Standards has a legitimate role of government in supporting the Nation's science and technology base. It is the unbiased arbiter of numerous technology issues relating to metrology, the science of measurements. The NBS Organic Act of March 3, 1901, wisely recognized this central, basic role of NBS as the leader and technical support structure for weights and measures elements of our economy and commerce. As technology has advanced and become more complicated, the role has taken on even greater significance. It now provides a sound national system upon which physical quantity measurements are based that are vital to new product research, productivity, assurance of quality, maintenance of equity in trade and in a multitude of defense and space applications. We see it as the most important component of all the Department of Commerce efforts to advance, aid and support American industry.

Yet, despite the critical and elemental role of NBS to the vitality of America's industry and technology, it has historically been underfunded to execute its basic role and the additional tasks assigned to it over the years. It has been burdened with programs and assignments that have been important to the national interest and which the excellent scientific knowledge base of the Bureau has been competent to fulfill. Nonetheless, these added programs were not matched with needed funds. Typically NBS has been provided initializing funds for new projects far less than the projects needed, with intentions for future increases. These intentions were rarely carried out and NBS's basic metrology mission suffered funding depressions, as did other added tasks, in an effort to satisfy a succession of Administrations and Congresses.

All of this has left NBS in a weakened condition in terms of finances, manpower and technical vitality. We feel that the funding level of NBS should exceed $200 million per year. We are pleased to see an increment towards this goal in this year's budget. The history of NBS budget requests to the Department of Commerce has shown levels consistently in excess of $200 million. However, the requested amounts have not been passed on through DOC and the Office of Management and Budget. While this $200 million level is needed immediately, in recognition of the federal deficit posture we would recommend that the NBS budget be built up to at least $200 million over a period of three to five years. In parallel with this, we recommend the involvement of technical and industrial organizations with NBS to outline a plan to set priorities and actions to restore NBS as a fully adequate resource.

We were pleased to note that the 1987 Authorization Act included an alternative personnel management system for NBS scientific and engineering personnel modeled after a similar successful program at Navy Laboratories at San Diego and China Lake, California. This was an outgrowth of the efforts of the Honorable Don Fuqua, former Chairman of the House Committee on Science and Technology to implement concerns expressed by Hon David Packard reflecting the views of the White House Science Council's Federal Laboratory Review Panel. It allows the Director of NBS to pay more competitive salaries to attract, motivate and retain NBS's most essential element, its scientists and engineers, and to improve the overall ability of the Bureau to manage and perform scientific and technical work. However, even with this enlightened tool at hand, it is understood that the government will continue to skimp unwisely on this valuable program by not providing increased funding to pay for it. So history will repeat itself. A New program without new funds; new funds taken out of current programs; overall effectiveness reduced; a gain turned into a loss. Those who impose such restrictions are short sighted and obstructive of the program's objectives. Additional funds should be added to the NBS budget immediately to allow an orderly and reasonable implementation of the plan without still further detriment to existing programs. This is particularly important since we expect the NBS demonstration program to show the way to better management of one of the government's key resources, its scientists and engineers.

COMPUTER SCIENCE AND TECHNOLOGY PROGRAMS

The United States has long been recognized as the World leaders in computer technology. Yet, today, our computer industry is in serious trouble. As recently as last year, this industry provided a healthy positive counterbalance to our international trade deficit. However, we are now fast approaching a negative balance which portends a hastening of decline of even this last bastion of US technological dominance. we feel strongly that there is a legitimate, necessary government role in supporting the competitiveness of this industry.

One of the key government functions that provides an underlying basis for our technological society and production mechanisms is support for the development and implementation of industrial standards of conformity. These are written technical standards and specifications prepared to assure the form, fit and functional compatibility of equipment and systems developed and built for US and international markets. These include standards developed and established by the Government for its own use in defining and acquiring products and services. It also involves those national and international industrial standards development activities which the Federal Government supports through widespread participation in voluntary standards efforts.

The IEEE is a major partner in many of these efforts. As a result, we in the IEEE are very strong supporters of a healthy standards program within the NBS as an important and unique contribution to our nation's industrial competitiveness. The NBS plays a major role in these nationwide activities. In the case of computer standards and specification, the critical operating unit in NBS is the Institute for Computer Science and Technology (ICST). Its program supports the Department of Commerce goals of promoting the development and application of science and technology in US industries and increasing their competitiveness. It is especially meaningful and essential to the Department's goals in products and services growth and exports in telecommunications, computer and information products and related services. It aids the DOC in assuring the development and acceptance of US generated technical standards based on US technology and manufacturing methodology. It further improves the Federal Government's cost-effective use of computer and telecommunications technology, as the largest single user of the technology in the nation.

The IEEE strongly supported the DOC goals in this matter. They are consistent with the IEEE's concern for the technical and economic health and vitality of US industry and of its relative position in the world marketplace. In this connection, we are seriously concerned with the funding levels planned for the ICST in 1988. The Institute was funded at $10 million in 1985, $9.6 million in 1986 and $7.5 million in 1987. The 1986 level was inadequate; the 1987 was devastating. It is the IEEE's position that a failure to fund at adequate levels will lead to a major loss to US industry and seriously handicap its competitive posture in domestic and international markets. We strongly support a funding level equivalent to the 1985 level of $10 million, adjusted upward for inflation. This should be followed by real increases to bring the ICST to a funding level of at least $15 million in current dollars.

The Government spends over $15 billion annually on information technology. Cost benefit studies by independent consultants have identified over $300 million in Federal cost savings for data-base software standards alone. Comparably large savings are anticipated through standards being completed in the areas of networking protocols, computer security, and computer based message systems. Computing technology is at the heart of efforts to improve productivity and cut costs in government, industry and business. Computer hardware, software and communication standards is one of the areas of greatest cost leverage. This is where the ICST provides crucial national leadership and coordination that maximizes compatibility and efficiency.

Funding of the ICST to increased levels is a sound investment. The ICST is a source of objective, independent input while representing the interests of the Federal Government as a larger user of information technology. Its staff serves a key role in over sixty voluntary industry standards committees, providing critical technical input concerning technical specifications, and in the measurement and testing of the draft standards. Their participation further assure the necessary continuity and impetus to the standards drafting process, a process which easily stalemates without the presence of independent, but highly motivated participants representing consumer viewpoints. For example, it is clear that the many suppliers of computer networking services need the unifying force of an unbiased, internationally recognized and respected third party if we are to avoid an uncontrolled, disruptive, and wasteful proliferation of incompatible computer hardware and software that would be chaotic to both users and vendors, but especially to users such as the Federal Government. This has been the role played by the ICST in developing and facilitating the adoption of key standards. It provides a fundamental underpinning for the computer industry which enhances productivity and market demand while leveraging innovation into new products. We are dismayed at the 1987 cuts in the ICST's networking program and place a high priority on restoration of these funds.

The Institute for Computer Science and Technology at NBS is a small and fragile resource in the much larger Department of Commerce structure. It has, however, a key role that far exceeds its size. In fact, its small size versus its impact is evidence of the economy of this highly effective program at a time when competitiveness and negative trade balances are of such major concern. The private sector is neither able nor willing to substitute for the unique role of the ICST. This position and the importance of the ICST has been underscored by the many distinguished witnesses that have given testimony before the Congress over the last several years. We join them in support of the ICST. We believe that funding of the ICST at increased levels will produce a highly leveraged return on investment. For example, we feel the ICST should have standards research underway in the area of reliability recovery and integrity of complex computer systems. Both government and the private sector rely increasingly on such systems. An expanded role for the ICST is of high national interest as a vital element to a healthy and vibrant information technology infrastructure in the United States and in competition in worldwide markets.

MEASUREMENT SCIENCE AND PRECISION MEASUREMENT STANDARDS

There has been a steady decline in the capability of the Federal Government to assure the veracity and authenticity of precision measurements used in the marketplace and in defense programs. U.S. industry needs precise state-of-the-art measurements and measuring systems to provide advances in technology, to perform research, and to design better, more competitive equipment. Precisely controlled measurements are at the heart of technological advancement and product competitiveness. The ability to do this gives a nation the edge in worldwide technology commerce. We are gravely concerned that work on more precise and accurate measurements in the USA is slipping badly, as is our relative world position in making and controlling extremely accurate measurements.

Early in this century our Government recognized its basic role to maintain and disseminate such measurement standards as to assure the equity of trade and of the marketplace. That is, in the conduct of commerce, they wanted industrialists to know that they were manufacturing and buyers to know what to expect to get for their money. That basic role is unchanged to this day and its need is far greater as increasingly precise and complex new technologies have appeared. This fundamental and basic role is contained in the Organic Act of 1901 with numerous recent amendments. It assigns mission and functions to the National Bureau of Standards (NBS) that encompass this role. IEEE supports the intent of the Organic Act that the fundamental function of NBS is the research, development and dissemination of adequately precise and accurate measurements, measurement standards, and measurement methods. This is its central role. They are considered the leaders and arbiters of the national measurement system as a legitimate function of centralized government. It is the view of the IEEE that all other NBS functions that compete and interfere with these activities, while important in and of themselves, are of less importance and of lower priority.

Economic estimates have shown that $160 billion per year are spent on measurements in the USA. These measurements are derived from an overall national resource that can best be described as a national measurement system. While the National Bureau of Standards are the leaders of the national measurement system, this leadership role has been subverted by numerous events and erosions that have seriously weakened the resources of NBS to conduct its fundamental business. Inadequate funding for these most basic functions is at the heart of the atrophy and neglect of NBS. Needed technological advances in measurement to parallel advances in science and engineering are not happening. The tools for the Nation's leading engineers and scientists are not there when needed.

The transfer of technology from research laboratories into manufacturing is vitally linked to precise, accurate, and adequate measurement capability. Manufacturing process and product quality are highly dependent upon precision measurements. All measurements in the USA must be linked to common measurement references to avoid chaos in the laboratory, factory and marketplace. It is the assigned role of the NBS to furnish those common measurement references; yet, NBS has not been furnished the financial support to do the job. All of science and industry suffers and our economy pays the price. Manufacturing of innovative products is seriously delayed if no adequate means exists to precisely and accurately measure the new technology that is discovered. Defense and space capabilities are needlessly limited and endangered by inability to more precisely measure and control systems.

When the NBS does not perform, US industry must turn to foreign makers of precision measurement equipment for our needs, or develop their own measurement methods and systems. In either event, we are faced with increasing foreign market dependence or the needless duplication and expenditure of scarce resources for advanced technology projects. If NBS could do its job, the foundation for measurement resources would be there, the foreign dependence could be avoided, and the wasted effort could be used to advance America's competitive position. Proper funding and priority placement is the key to NBS success in this most basic function. Necessary emphasis and requirements must be placed on the Department of Commerce and the NBS to assure this success and to maintain proper focus on measurement science and technology.

The lack of adequate resources in the DOC to meet the needs of the national measurement system particularly impacts the needs of the nation in electronics technology. This technology forms the largest manufacturing group in the U.S. with 2.3 million employees. The $215 billion electronics market represents about 5.5% of the gross national product and is growing. Export of electronics equipment is now about $40 billion. Exports exceeded imports by $5 billion five years ago, but it is now reversed. In 1985 electronic imports exceeded exports by $9 billion; the 1986 estimate is for a $12 billion imbalance with the trend toward even greater trade deficits in future years.

In some frequency bands such as those needed for new satellite communication systems, no adequate NBS measurement standards capabilities exist. Because of increasing concern for the future of measurement capability to support electronics technology, two groups have merged within the IEEE to examine the problem and explore immediate and long term actions to regain lost ground and to achieve the high ground, once again. These engineers come from component, instrument, and system manufacturers, whose frustrations and concerns have reached such levels that they believe alrams aneed to be sounded. Their studies to date reveal that the NBS's measurement science capability has fallen behind more seriously than originally imagined by the technical community. They conclude that, while private industry can contribute to electronics measurement technology, the NBS has the fundamental technical and leadership role with regard to the national measurement reference standards segment. They further realize that research into new measurement frontiers must take place at the national reference level in advance of, or, at least in parallel with advances in industry. Most desirably, the advances through NBS research would function in an iterative process with NBS and industry working together in teamwork. There is no way this can happen in the current weakened funding environment at NBS. Private funding to supplement NBS's current funding may sound attractive, but the two IEEE study groups and many others conclude that expectations of a simultaneous uprising or mutually compatible and motivated companies is highly unlikely, although ideally attractive as a substitute to increased government funding.

The need for measurement technology support for electronics covers the entire electromagnetic domain from direct current to optical systems. In the lightwave measurement technology area, which includes fiber optics, deficiencies are most pronounced at power levels of 1 to 200 milliwatts at wavelengths of 600 to 860 nanometers and from 1 to 8 milliwatts at 1300 to 1550 nanometers. Attenuation measurements and related primary standards are also deficient from 0.1 to 100db at accuracies at the test set usage level of 0.1db/10db. In the millimeter wave and microwave technology area, some 75 specific deficiencies in combinations of frequency versus measurement parameter were exposed by a recent IEEE study. The amount needed over the next five years to correct the most serious deficiencies has been estimated at $38 million. These include power, attenuation, impedance and thermal noise in the millimeter/microwave frequency spectrums above 18 GHz where the highest priority needs were identified. In the areas of general electronics measurement, known within NBS as product control and quality assurance, deficiencies exist in alternating current measurement standards for support to devices at accuracies of better than 5 parts per million from 40 KHz; more accurate four terminal-pair impedance measurements to 10Mhz; and transportable capacitance standards of greater stability and environmental resistance.

These are but a few of the many deficiencies that need immediate attention. These are the needs that form a major backlog of measurement standards projects at NBS. They must first be overcome before progress can be made to aid industry in advancing measurement science to support the electronic industry and electronic technology. An infusion of funding is essential to catch up with the backlog and to develop technical muscle at NBS to undertake new research and development of advanced measurement capabilities. We estimate that an additional amount of $25 million per year for the next 5 to 7 years is needed to get back on solid ground and rebuild our national measurement standards competence.

The IEEE considers this matter of great importance to the national interest. We have recommended to the Department of Defense that such measurement deficiencies imperil our defense systems and have urged a study within DOD to explore existing and future needs and solutions. The Congress may wish to have the Office of Technology Assessment undertake a similar study in the broader national interest.

The IEEE statements made herein seek to awaken all of those in our nation involved with protecting and promoting our most fundamental technical resources. Measurement and their underlying calibrations seem to be taken for granted by many otherwise knowledgeable people, just as the millions of measurements associated with production and readiness inspections of such systems as the space shuttle were taken for granted. Until something goes wrong, few realize the significance that precise, accurate and dependable measurements play in our high technology culture. Our national measurement resources require constant maintenance just to retain our momentary position. To advance technically, our measurement capability must advance. Both maintenance and advancement must receive our constant vigilance and attention to avoid the atrophy that can create disasters at worst, and delays at best.

SUMMARY

The specific concerns of the IEEE regarding the Department of Commerce budget for the National Bureau of Standards are as follows:

(1) That the overall NBS appropriation should reach levels greater than $200 million as soon as possible. Numerous programs are underfunded and weaken the effectiveness of all NBS programs as a result.

(2) That the NBS demonstration personnel management program be provided necessary funds for earliest possible implementation. The lack of added funds to start the effort is false economy and can only damage programs already in place.

(3) That funding in 1988 for the Institute for Computer Science and Technology (ICST) be raised to levels equivalent to $10 million in 1985 dollars. Cuts made to the ICST funds over the past few years have had a serious detrimental effect on the degree of ICST contributions to the needs of the U.S. industry and to its users. Over the next three to five years, ICST funding needs to be raised to $15 million.

(4) That the budgeted amounts for fiber optics, millimeter wave/microwave, and product control and quality assurance be increased by $25 million over amounts received in 1987. This year's DOC budget requires for funding for NBS is inadequate to support the most basic needs of the measurement standards elements and programs of NBS. Some small increases have been requested for lightwave measurement technology and product control and quality assurance. None have been requested for millimeter wave and microwave, which is most disappointing. All three of these areas need a major infusion of funding. Lightwave measurement

technology needs an additional $9 million, product control and quality assurance needs an additional $8 million; and millimeter wave and microwave needs an additional $8 million. All of these areas have had visibility as initiatives in former budget submissions and were extremely deserving of support then, but in significantly increased amounts.

(5) That competing program within NBS not be allowed to siphon funds from the above measurements standards programs if reductions are levied against these other programs, or if funds are added to the measurement standards program.

(6) That where the DOC or OMB have included requests for funding of initiatives that address the measurement technology deficiencies disclosed in this statement, they receive the highest priority. Such initiatives have made their way into the budget process in the last three years, only to be eliminated or out-ranked by other non-measurement technology efforts. While many of these other initiatives are technically attractive, their presence results in the atrophy of the measurement standards resource. Although a zero growth or shrinking budget base has existed at NBS over the past several years, new programs and projects have been added. These, typically, have resulted in further draining of funds available to the measurement technology programs at NBS. We are opposed to any such actions. Our recommendation to raise the NBS budget above the $200 million level should provide some relief to the destructive financial conflicts that now exist.

Mr. **Walgren**. We appreciate that for the record. I apologize. I should respond to this vote, and so we should suspend for five minutes. Mr. Boehlert will be back, I hope, just before I am, but I have to ask Mr. Hurt if we might hold until then.

Mr. **Hurt**. No problem.

Mr. **Walgren**. Thank you very much.

[Recess.]

Mr. **Walgren**. And, please, Mr. Hurt, thank you for your indulgence, and we are happy to recognize you.

Mr. **Hurt**. I'm a Vice President of the General Engineering Group of the American Society of Mechanical Engineers, and I serve as the Chairman on the ASME, NBS Interaction Committee. So, my comments represent the consensus of that committee rather than at this time in an official position of ASME.

The American Association of Engineering Society has also endorsed this statement.

I was interested in what Dr. Pry said regarding the lack or the loss of R&D efforts that are going on in the industrial firms in this country at this time. I'm a past president of Goodyear Atomic Corporation, one of the major subsidiaries of the Goodyear Tire and Rubber Company that is now out of existence as a result of the hostile attempt takeover by Jimmy Goldsmith. So, I know what Dr. Pry was talking about when he talks about the victims of restructuring.

We're pleased to have this opportunity to present our views on the Administration's Fiscal Year '88 budget request for NBS. ASME has more than 113,000 members; and they're all involved in many applications of engineering. And thus, we have very strong interest in NBS.

Through the years ASME has had an extensive interaction with NBS, and specific examples of that interaction were contained in an appendix to our written statement.

As a result of this extensive interaction we in ASME have long known what it appears that a lot of others don't seem to realize; namely, that NBS plays a vital role in the technological strength of our country.

As we've seen both our energy and space—as we have seen in both our energy and space programs that often requires a crisis before attention is paid to a problem.

Now, perhaps, with the current competitiveness crisis we will see agencies such as NBS begin to receive the attention and appropriations so well deserved such as now, is being afforded to the National Science Foundation.

We feel this is especially important since NBS does not only research in measurements, but it's uniquely qualified, in our opinion, to move research out of the laboratory into the hands of industry.

In this regard we're pleased to note the nearly 14 percent increase, up the level of $138.6 million which the Administration has proposed for the Bureau during Fiscal Year '88. And on its face, this increase seeks generous, especially considering that the Bureau's budget has remained essentially stagnant over the past decade, if you factor inflation in.

However, on closer scrutiny we find that 13.6 million of that, 16 million increase is earmarked, not for programs, but for what one would consider the administrative or the inflationary matters such as pay increases, retirement benefits, depreciation. In fact, in that increase in the program budget is only 2.9 million or a mere 18 percent of the total increase.

Therefore, our initial enthusiasm over the overall increase for NBS is tempered by the fact that most of the new monies won't be spent at the program level, where we feel there is a sore need for increase funding.

It's especially true when one considers that NBS is dependent on outside sources for about 50 percent of its funding such as that that comes from other agencies. Outside funding is not always stable, and causes problems. I'm sure causes problems for the new planning for multi-year activities. Unless there's an adequate base for NBS activities, the organization can't maintain the ability to respond to the need of other agencies as well as those of industry.

And ideally, we'd like the Administration to commit itself to a vigorous long-term growth for the Bureau as it has for NSF.

Turning our attention to specific areas of the budget, we'll concentrate our comments on those areas of increase or decrease in the budget, and it isn't necessarily implied that the areas that we don't comment on aren't important. However, in the interest of time I'll limit myself to the major changes in the budget.

The major or the lion's share of the increase for NBS goes to changes in the base, not the program, as I've mentioned. The base budget, however, does include additional monies for two important efforts at NBS.

The first, the removal of hazardous polychlorinated biphenyls, and asbestos from the NBS facilities at both Gaithersburg and Boulder. We certainly support the request for the 2.88 million to remove those hazardous materials from the facilities.

Secondly, within the base budget we also support continued funding at the level of $2 million for Fiscal Year '88 for the Cold Neutron Research facility. This facility when completed will certainly enhance NBS measurement and the evaluation work on materials. We supported this program last year in our testimony, and we're pleased to see it proceeding along as planned.

With regard to the programmatic budget at NBS, we'd like to begin by discussing the proposed merger of the Centers for Fire Research and Building Technology and the attendant 3.8 million cut in those programs. During last year's budget deliberations an agreement was reached between your committee and the Office of Management and Budget concerning these two Centers. And in an effort to fund the Cold Neutron Research facility OMB agreed to $500,000.00 cuts in those budgets, as well as some cuts in other NBS programs. And in return, Congress authorized these—for authorizing these cuts, OMB agreed not to propose any further cuts or reorganization of the Fire and Building Programs through Fiscal Year '89.

Your Subcommittee, as well as the Full Committee held true to the bargain. However, we're amazed to find this year's budget, when released, that OMB has failed to live up to their end of that deal.

We rejected the Administration's contention that program cuts will be picked up by the private sector. And therefore, we recommend you reject the proposed cut of 3.8 million and fund the Fire and Building Programs at a level consistent with last year's agreement.

On others, we strongly support the proposed three and a half million increase for the Process Control Quality Assurance initiative.

We support the one and a half million increase in research funding on high performance composites.

And we strongly support funding for pilot program—for the pilot program to produce computerized standard reference databases. Through technical papers, journals, and conferences, ASME and other professional and technical societies have worked over the years to disseminate accurate technical data to the engineering community.

The development of computerized databases will provide engineers and scientists with ready access to the most up to date information. This will result, not only in time saved, but will ensure that designs reflect the most cost-effective methods available.

Although it isn't slated for an increase, we're pleased to note the continuation of the postdoctoral Research Associate Program. By providing fellowships directly to graduate students this program exposes young scientists and engineers to the Bureau in its programs. And even those that don't stay with the Bureau, certainly carry back to either the academic field or to the industrial firm that they go to; what the Bureau is all about.

This concludes my testimony, Congressman Walgren. Thank you again for the opportunity to express the views to the Subcommittee, and we'll answer any questions.

[The prepared statement of Mr. Hurt follows:]

The American Society of
Mechanical Engineers

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Washington, DC 20006-1202
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Statement of the

Task Force on the National Bureau of Standards

of the

American Society of Mechanical Engineers

on the

National Bureau of Standards

FY 1988 Budget Request

Before the

Subcommittee on Science, Research and Technology

Committee on Science, Space and Technology

U.S. House of Representatives

March 3, 1987

Mr. Chairman and Members of the Subcommittee:

My name is Nathan Hurt and I am vice-president of the General Engineering Group of the American Society of Mechanical Engineers (ASME). I also serve as chairman of the ASME/NBS Interaction Committee. My comments represent the consensus of that committee rather than an official position of ASME.

We are very pleased to have this opportunity to present our views on the Administration's Fiscal Year (FY) 1988 budget request for the National Bureau of Standards (NBS). Because ASME's more than 113,000 members are involved in many applications of engineering, we have a strong interest in NBS. Through the years ASME has had extensive interaction with NBS including standards writing committees, workshops and conferences. Specific examples of ASME interaction with the Bureau are contained in an appendix to our written statement.

As a result of our extensive interaction, ASME has long known what others don't seem to realize. Namely, the NBS plays a vital role in the technological strength of our country. As we have seen in both our energy and space programs, it often requires a crisis before attention is paid to a problem. Perhaps with the current "competitiveness" crisis, we will see agencies such as NBS begin to receive the attention and appropriations they deserve such as that now being afforded to the National Science Foundation (NSF). This is especially important since NBS not only does research, but is uniquely qualified to move research out of the laboratory into the hands of industry.

In this regard, we are pleased to note the nearly fourteen percent increase, up to a level of $138.6 million, which the Administration has proposed for the Bureau during FY 1988. On its face, the increase seems generous, especially considering that the Bureau's budget has remained essentially stagnant over the past decade, when inflation is factored in. However, upon closer scrutiny one finds that $13.6 million of the $16.6 million increase is earmarked not for programs, but for what one would consider administrative items such as pay increases, retirement benefits, depreciation, travel and communications cost, etc. In fact, the net increase in program budgets is $2.9 million or a mere 18% of the $16.2 million total increase.

Therefore, our initial enthusiasm over the overall increase for NBS is tempered by the fact that most of the new monies will not be spent at the program level which are sorely in need of increased funding. This is especially true when one considers that NBS is dependent upon outside sources, such as other agencies, for a major portion of its funding. Outside funding is not always stable and causes problems in planning for multi-year activities. Unless there is an adequate base for NBS activities, the organization cannot maintain the ability to respond to the needs of other agencies, as well as those of industry.

Ideally, we would like the Administration to commit itself to a vigorous, long-term growth program for the Bureau, as it has for NSF. Short of that, however, we recommend that, at a minimum, the Administration and Congress should provide modest increases for the vital programs at NBS.

We would like to turn our attention now to specific areas of the budget. We will concentrate our comments on the areas of increase and decrease in the budget. This is not to imply that the areas we do not comment on are not important. However, in the interest of time, we will limit ourselves to the major changes in the budget.

As we noted in our introduction, the lion's share of the increase for NBS goes to changes in the base, not to programs. The base budget, however, does include additional monies for two important efforts at NBS.

The first is the removal of hazardous polychlorinated biphenyls (PCBs) and asbestos from NBS facilities in Gaithersburg, MD and Boulder, CO. We support the request for $2.88 million to remove these hazardous materials from NBS facilities. It would not be prudent to force NBS to gut already strapped programmatic budgets to fund this necessary task.

Secondly, within the base budget, we also support continued funding, at a level of $2 million for FY '88, for the cold neutron research facility. This facility, when completed, will greatly enhance NBS measurement and evaluation work on materials. We supported this program in our testimony last year and we are pleased to see it proceeding along as planned.

With regard to the programmatic budget at NBS, we would like to begin by discussing the proposed merger of the Centers for Fire Research (CFR) and Building Technology (CBT) and the attendant $3.8 million cut in those programs. During last year's budget deliberations an agreement was reached between your committee and the Office of Management and Budget (OMB) concerning CFR and CBT. In an effort to fund the cold neutron research facility OMB agreed to $500,000 cuts in the budgets of the CFR and CBT, as well as cuts in other NBS programs. In return for Congress authorizing these cuts, OMB agreed not to propose any further cuts or reorganization of the fire and building programs through FY 1989. Your subcommittee, as well as the full committee, held true to the bargain. However, we were amazed to find when this year's budget was released that OMB failed to live up to their end of the deal.

We reject the Administration's contention that programs cut will be picked up by the private sector. Therefore, we recommend that you reject the proposed cut of $3.8 million and fund the fire and building programs at a level consistent with last year's agreement.

We would now wish to comment briefly on the proposed programmatic increases of NBS:

1) We strongly support the proposed $3.55 million increase for the Process Control Quality Assurance initiative. One of the major challenges facing U.S. industry is the ability to match or exceed the quality of foreign goods in the world marketplace. The engineering services provided by NBS are vital to industry's ability to monitor their production process and to insure that the products ultimately produced are of the highest quality.

Through our ASME/NBS Interaction Committee, we find that the managers of NBS's engineering program recognize the need to broaden their traditional role from merely measuring physical or chemical properties to one of helping industry design products that are easier to manufacture, more reliable to use and easier to maintain.

2) We also support the $1.5 million increase in research funding on high performance composites. Composite materials already play an important role in the aerospace industry. This program is designed to assist in the commercialization of composites by increasing their reliability. This is another area vital to U.S. international competitiveness.

3) We strongly support funding for the pilot program to produce computerized standard reference databases. Through technical papers, journals and conferences, ASME and other professional societies have worked over the years to disseminate accurate technical data to the engineering community. The development of computerized databases will provide engineers and scientists with ready access to the most up-to-date information. This will result not only in time saved, but will insure that designs reflect the most cost effective methods available.

4) Although it is not slated for an increase, we are pleased to note the continuation of the postdoctoral Research Associate Program. By providing fellowships directly to graduate students this program exposes young scientists and engineers to the Bureau and its programs. This program helps NBS attract and, in some cases, retain top-quality young engineers and scientists. We strongly support this initiative.

This concludes my testimony, Mr. Chairman. Thank you again for the opportunity to express our views to the Subcommittee. I will be happy to answer any questions you or the Members of the Subcommittee may have.

Examples of Interactions
Between the
National Bureau of Standards
and the
American Society of Mechanical Engineers

Center for Manufacturing Engineering (CME)
National Engineering Laboratory

Conferences:

December 1986 Symposium of Integrated Intelligent Manufacturing: Analysis and Synthesis

- Charles McLean - Author/Presenter "Vertical Workstation of the AMRF: Software Integration," submitted for publication.
- Ed Magrab - Author/Presenter "Vertical Workstation of the AMRF: Equipment Integration," submitted for publication.
- Peter Brown/Charles McLean "Interactive Process Planning in the AMRF"

1986 ASME Winter Annual Meeting

- Slocum A., Greenspan, L., and Peris, J., "Design and Implementation of a Five Axis Robotic Micromanipulator," accepted for presentation.
- Slocum, A., Yee, K., Peris, J., and Jurgens, P., "A Servo-controlled Pneumatic Double Gripper with Changeable Fingers," accepted for presentation.
- Donmez, A., Liu R., Barash, M., "A Generalized Mathematical Model for Machine Tool Errors," accepted for presentation at Symposium on Sensors and Controls for Manufacturing.

1986 ASME International Computers in Engineering Conference and Exhibition

- Howard Bloom - Discussed software standards with ASME Committee chaired by Dr. Raghaven
- Peter Brown - Session Chairman, Robotics I - Manipulation
- Papers reviewed by Bloom and McLean

July 1985 ASME Panel

- Peter Brown - Vice Chairman and panel member

August 1985 ASME Board of Govenors, Manufacturing Sciences Program Meeting

- Robert Hocken

September 1985 ASME Design Technology Conference

- Charles McLean - Panel member

1985 ASME International Computers in Engineering Conference and Exhibition

- Howard Bloom - Keynote Speaker
- Charles McLean - Chairman of Expert System Session
- Papers presented by Charles McLean and Albert Jones

August 1984 ASME International Computers in Engineering Conference
- Charles McLean - Panel member of Expert System Session
- Papers coauthored by Charles McLean and Albert Jones

August 1983 ASME International Computers in Engineering Conference
- Charles McLean - Chairman of Flexible Manufacturing Systems Session

"Mechanical Engineering" (fall 1985):

- Donald Eitzen prepared article on NBS conical transducer

ASME Committee Memberships:

B46 - Committee on Surface Roughness
- T. V. Vorburger and Clayton Teague
- Participated over past 10 years and helped to carry out two major revisions of the surface roughness standard.
- These members are in the process of formalizing a proposal to ASME and the Committee that ASME be the U.S. sponsor or participating sponsor to support the data collection to form the National/International Surface Roughness Data Bank.

Pressure Vessel Codes - Acoustic Emission
- Franklin Breckenridge

Y14.26 - Computer Representation of Product Definition Data
- Brad Smith
- This committee and its parent committee Y14, Engineering Drawings and Related Practices, form the route for ANSI's review and approval of the NBS project on IGES.

B89.1.12 - Coordinate Measuring Machine Performance Evaluation
- Robert Hocken and Thomas Charlton
- Coordinate Measurement Machine standard worked in consensus with this committee.

Center for Electronics and Electrical Engineering (CEEE)
National Engineering Laboratory

ASME Committees:

K-16 Committee on Heat Transfer in Electronic Equipment
- o Frank Oettinger - established working relationship with subcommittee on measurement standards and procedures to interface with related SEMI activities.

Other:

An ASME representative serves on the executive committee of the NBS-sponsored VLSI Packaging Workshop.
- o George Harman is CEEE contact.

Center for Fire Research (CFR)
National Engineering Laboratory

Conferences:

Second ASME-JSME Thermal Engineering Joint Conference, to be held March 22-27, 1987, Honolulu, Hawaii.
- o Len Cooper, along with B. Farouk of Drexel University, organizer of the Heat and Mass Transfer in Compartment Fires Session.

- o Submitted for presentations at above sessions and publication in conference proceedings:

  "The Cooling Effect of a Single Evaporating Droplet on a Hot Semi-Infinite Metal Body," de Marzo, M., Evans, D.D. and Trehan, A.K.

  "Interaction of Radiation and Conduction in Polymeric Materials Exposed to External Thermal Radiation," Finlayson, E., Aung, W. and Kashiwagi, T.

  "Heat Transfer Through Multilayer Boundaries: Implementation and Validation," Jones, W. W. and DeWitt, C.

  "Investigation of the Effects of a Stratified Two-Layer Environment on Fire Plume Tempertures," Morehart, J. and Evans, D. D.

"An Experimental Study of the Transient Thermal Response of Unconfined Ceilings Above Fire Plumes," Woodhouse, A., Marks, C. H. and Cooper, L. Y.

23rd National Heat Transfer Conference 1985
- Len Cooper and A. Woodhouse presented co-authored paper, "The Buoyant Plum-Driven Adiabetic Ceiling Temperature Revisited."

22nd National Heat Transfer Conference 1984
- Len Cooper presented papers

21st National Heat Transfer Conference 1983
- Jim Quintiere organized the fire dynamics and fire heat transfer sessions.
- Cooper, Evans, and Kashiwagi presented papers at these sessions published by ASME in a single volume which serves as an introduction to fire science, fire dynamics, and heat transfer, (edited by Jim Quintiere).

Symposium on Modeling of Environmental Flow Systems - November 13-18, 1983.
- "A Buoyant Source in the Lower of Two, Homogeneous, Stably Stratified Layers" - A Problem of Fire in an Enclosure," L. Y. Cooper.

Representative papers accepted for publication:

- Mechanical Engineering - "Heat and Mass Transfer Research Topics in Fire and Controlled Combustion Systems," L.Y. Cooper and L.A. Kennedy (Ohio State University, 1986.

- Journal of Heat Transfer - "The Buoyant Plume-Driven Adiabatic Ceiling Temperature Revisited," L.Y. Cooper and A. Woodhouse, 1986.

- Journal of Heat Transfer - "Thermal Response of Unconfined Ceilings Above Growing Fires and the Importance of Convective Heat Transfer," L.Y. Cooper and D.W. Stroup, 1986.

ASME Committee Memberships:

K-11 Committee on Heat Transfer in Fire and Combustion Systems
- Jim Quintiere -Chairman of the K-11 Committee (1986-1988)
- Len Cooper
- Committee runs 5-10 sessions per year at the ASME Winter Annual Meeting and the National Heat Transfer Conference as well as special meetings that occur.

Center for Applied Mathematics (CAM)
National Engineering Laboratory

On July 21, 1986, Jeffrey T. Fong of the NBS Mathematical Analysis Division became a Fellow of the American Society of Mechanical Engineers, "for distinguished contribution to the advancement of the arts and sciences of mechanical engineering practice through research, publication, consulting, and conference management."

Jeffrey Fong's extensive interactions are attached.

Summary of Recent (1982-) & Continuing Interactions with ASME

by

Jeffrey T. Fong
Mathematical Analysis Division
Center for Applied Mathematics

Legend:
AMD = Applied Mechanics Division.
ASME = American Society of Mechanical Engineers.
ASNT = American Society for Nondestructive Testing.
CED = Computer Engineering Division.
CRN = Committee on Research Needs.
CSR = Committee on Software Research.
NDE = Nondestructive Evaluation.
PVPD = Pressure Vessels & Piping Division.
PVRC = Pressure Vessel Research Committee.

Type A - Technical:

No.	Period	Position	Benefits to NBS Divisions
A-1	1982 - 1983	Chairman of ASME-ASNT-NBS-PVRC Symposium on NDE Reliability Portland, OR, June 20-21, 1983, for ASME PVPD & NDE Engrg. Div.	401, 430, 450, 460, 711, 714, 737.
A-2	1982 -	Member, Elasticity Committee, for ASME AMD.	100, 401, 420, 430, 440, 450, 520, 523, 711, 737, 741, 746.
A-3	1983 -	Associate Editor, ASME J. of Pressure Vessel Technology.	401, 420, 430, 440, 450, 711, 714, 737.
A-4	1983 - 1984	Chairman of ASME-ASIS-MPC-NBS & Editor of Proceedings of Symposium on Engineering Databases: Software for On-Line Applications, San Antonio, TX, June 18-20, 1984, for ASME PVPD & Committee on Research Needs.	450, 504, 642, 711, 713, 714, 746.
A-5	1984 -	Project Director of a Proposed ASME-NBS Software Research Project entitled DATAX, for ASME Committee on Software Res.	401, 420, 430, 440, 450, 460, 504, 642, 711, 713, 714, 746.

Type A - Technical (Continued):

No.	Period	Position	Benefits to NBS Divisions
A-6	1984 -	Technical Program Chairman of ASME 1986 Joint PVP & CED Conference, Chicago, for ASME PVPD.	401, 420, 430, 440, 450, 460, 504, 642, 711, 713, 714, 737.
A-7	1984 -	Associate Editor for Database, ASME J. of Computer in Mechanical Engineering (CIME).	401, 420, 430, 440, 450, 460, 504, 642, 711, 713, 714, 737.
A-8	1984 -	Technical Program Chairman of ASME-Co-Sponsored 6th Int. Conf. on Pressure Vessel Tech. Beijing, China, Sept. 1988.	401, 420, 430, 440, 450, 460, 504, 642, 711, 713, 714, 737, 741, 746.

Type B - Policy:

B-1	1982 - 1985	Program Chairman & Member of Executive Committee, ASME PVPD.	
B-2	1984	Member, ASME Task Force on ASME/NBS Interactions.	
B-3	1985 -	Member, ASME Technical Opportunities & Planning Committee.	
B-4	1985 -	Vice-Chairman & Chairman-Elect, ASME Pressure Vessels & Piping Div.	
B-5	1986 -	Chairman, ASME Pressure Vessels and Piping Division.	

Type C - International:

C-1	1984 - 1985	Special Assistant to ASME President (Kotnick) & Exec. Dir. (Allmendinger) for Planning of an official visit to China; and Member of an ASME Delegation to China, May 13-28, 1985.	100.
C-2	1985 -	Special Assistant to ASME Exec. Dir. (Allmendinger), and Managing Director for Codes & Standards (Green) for Planning of the Hosting of an official visit to the U.S. by the China National Standards Committee of Pressure Vessel.	100.
C-3	1985	Honorary Advisor to the China National Standards Committee of Pressure Vessel, PRC State Bureau of Standards, Beijing, China	100.

Center for Chemical Engineering (CCE)
National Engineering Laboratory

Conferences:

1988 10th ASME Symposium on Thermophysical Properties (NBS Gaithersburg)
- o Dr. A. Cezairliyan and Dr. J. M. H. Sengers will organize.

23rd Annual ASME/AICHE National Heat Transfer Conference 1985
- o Santora, Yeh, and Semerjian's paper, "The Transport and Growth of Soot Particles in Laminar Diffusion Flames" accepted for presentation.
- o International Symposium on Fluid Flow Measurement, Washington, DC, Nov. 16-19, 1986; jointly sponsored by AGA, API, ASME, GPA, GRI and NBS.
- o N. A. Olien, member of organizing committee.

June 1985 9th ASME Symposium on Thermophysical Properties (NBS Boulder, Colorado)
- o Dr. Hanley - Chairman

ASME Committee Memberships:

ASME Research Committee on the Properties of Steam
- o Dr. J.M.H. Sengers and Dr. J.V. Sengers

K-7 Thermophysical Properties of the Heat Transfer Division
- o Dr. A. Cezariliyan, Dr. H. J. M. Hanley, and Dr. J.V. Sengers

Dr. George E. Mattingly's membership include:
- o ASME (Main) Committee on the Measurement of Fluid Flow in Closed Conduits (Member)
- o ASME SC-2, Pressure Differential Devices (Member)
- o ASME SC-6, Glossary of Terms for Flow Measurements (Chairman)
- o ASME SC-14, Measurement of Fluid Flow Using Gravimetric and Volumetric Techniques (Chairman)
- o ASME SC-15, Committee on Vortex Shedding Type Flowmeters (Chairman)
- o ASME SC-16, Committee on Installation Requirements for Orifice, Venturi, and Nozzles (Member)
- o ASME (Main) Research Committee on Fluid Meters (Member)
- o ASME SC-11, Test Methods and Calculation Procedures (Chairman)
- o ASME Ad Hoc Committee on Flowmeter Installation-Effects Research (Member)
- o International District Heating Association (IDHA) Fluid Metering Committee (Member)

ASME K-6 Technical Committee, Heat Transfer in Energy Systems
- o Dr. H.G. Semerjian

ASME K-11 Committee on Heat Transfer in Combustion Systems
- o Dr. H.G. Semerjian

ASME PTC 19.18, Committee on Humidity Determination (Member)
- o S. Hasegawa

ASME Research Committee on Properties of Steam
- o Dr. J. M. H. Sengers and Dr. J. V. Sengers

Center for Building Technology (CBT)
National Engineering Laboratory

Conferences: (See attached list of related papers)

Ninth Solar Energy Division Conference 1987
- A.H. Fanney - Session Chairman
- B. Mahajan - Session Chairman

Eighth Solar Energy Division Conference 1986
- B. Mahajan - Session Chairman
- A.H. Fanney - Session Chairman

106th Winter Annual Meeting 1985
- M.E. McCabe - Session Vice-Chairman

105th Winter Annual Meeting 1984
- M.E. McCabe - Session Organizer and Chairman

Fifth Solar Energy Division Conference 1983
- A.H. Fanney - Session Chairman

Fourth, Sixth, and Seventh Solar Energy Division Conferences also had NBS participants.

ASME Committee Memberships:

Solar Testing and Measurement Committee, Solar Energy Division
- A.H. Fanney - Chairman, 1984 - 1987
- B. Mahajan
- M.E. McCabe

ASME Journal of Solar Energy Engineering (See attached list of NBS papers)

ASME Journal of Applied Mechanics (See attached list of NBS papers)

Recent Discussions on Cooperative Research:

- Howard Clark (ASME) and Charles Culver, Bruce Ellingwood, & Spencer Wu
- Projects under consideration include work in structural mechanics (e.g. dynamics, nonlinear analysis, and system identification).
- NBS is exploring potential other Federal agency and industrial sponsors for this work.

CBT Attachment

Papers Prepared for ASME Conference

Fanney, A.H. and Dougherty, B.P.,"A Self-Heated Thermistor Flowmeter for Flow Measurements in a Thermosyphon Solar Hot Water System" presented at the Eighth Solar Energy Conference, 1986.

Mahajan, B.M., "Interzonal Natural Convection for Various Aperture Configurations" presented at the 106th Winter Annual Meeting, 1985.

Mahajan, B.M., "Flow Coefficients for Interzonal Natural Convection for Various Apertures" submitted for Ninth Annual Solar Energy Conference

Liu, S.T., "Experimental and Analytical Investigation of Solar Radiation on Interior Surfaces of a Sunspace" submitted for Ninth Annual Solar Energy Conference

McCabe, M.E., "Periodic Heat Conduction in Energy Storage Cylinders with Change of Phase" presented at AIAA/ASME Thermophysics and Heat Transfer Conference, 1986

Park, Choel, "An Adaptive Controller for Heating and Cooling Systems: Modeling, Implementation, and Testing," presented at 103rd Winter Annual Meeting, 1982.

Greenberg, J., "Plan for the Development of Test Procedures for Differential Temperature Controllers Used in Solar Energy Systems," presented at the 106th Winter Annual Meeting, 1985.

McCabe, M.E., "Solar Energy Absorption by Vertical Cylindrical Tube Absorbers in Sunspace Enclosures," presented at 104th Winter Annual Meeting, 1983.

McCabe, M.E., "Diurnal Effectiveness of Phase-Change Energy Storage Cylinders," presented at the Eighth Solar Energy Division Conference, 1986.

Mahajan, B.M. and Liu, S.T., "Initial Results from NBS Passive Solar Energy Test Facility," presented at the Fifth Solar Energy Division Conference, 1983.

Mahajan, B.M., Liu, S.T., and Reed, K.A., "Performances of Different Passive Solar Systems at the NBS Test Facility," presented at the 105th Winter Annual Meeting, 1984.

Mahajan, B.M. "Inter-room Air Flow by Natural Convection via a Doorway Opening," presented at the Eighth Solar Energy Division Conference, 1986.

Fanney, A.H. and Thomas, W.C., "Simulation of the Thermal Performance of Solar Collector Arrays," presented at the 103rd Winter Annual Meeting, 1982.

Klein, S.A. and Fanney, A.H., "A Rating Procedure for Solar Domestic Hot Water Systems," presented at the Fifth Solar Energy Division Conference, 1983.

Fanney, A.H., "An Experimental Technique for Testing Thermosyphon Solar Domestic Hot Water Systems," presented at the Sixth Solar Energy Division Conference, 1984.

Fanney, A.H. and Klein, S.A., "Performance of Solar Domestic Hot Water Systems at the National Bureau of Standards - Measurements and Predictions," presented at the Fifth Solar Energy Division Conference, 1983.

Fanney, A.H. and Thomas, W.C., "Three Experimental Techniques to Duplicate the Net Thermal Performance of an Irradiated Collector Array," presented at the Fourth Solar Energy Division Conference, 1982.

Reed, K.A., "Instrumentation for Thermal Performance Measurements," presented at the Fourth Solar Energy Division Conference, 1982.

Thomas, W.C. and Reed, K.A., "Effect of Infrared Irradiance on Collector Thermal Performance," presented at 105th Winter Annual Meeting, 1984.

Waksman, D., Thomas, W.C., "Conclusions and Recommendations for the Testing of Flat-Plate Solar Collector Thermal Performance and Durability," presented at Winter Annual Meeting, December 1984.

Thomas, W.C., Dawson, III., A.G., Waksman, D., "Testing Solar Collector Materials Durability by Integrated Day-Long Stagnation Temperature Measurements," presented at Solar Energy Division Fifth Annual Technical Conference, April 1983.

Dawson, III, A.G., Thomas, W.C., Waksman, D., "Evaluation of Absorber Stagnation Temperature as a Characteristic Performance Parameter of Flat-Plate Solar Collectors," presented at Winter Annual Meeting, November 1982.

Thomas, W.C., Dawson, III, A.G., Waksman, D., Streed, E.R., "Determination of Incident Angle Modifiers for Flat-Plate Solar Collectors," presented at Solar Energy Division Fourth Annual Conference, April 1982.

Papers Prepared for ASME Journal of Solar Energy Engineering

Fanney, A.H. and Dougherty, B.P. "A Self-Heated Thermistor Flowmeter for Flow Measurements in a Thermosyphon Solar Hot Water System," submitted 1986

Mahajan, B.M. "Measurement of Air Velocity Components of Natural Convective Interzonal Airflow," submitted 1986

Mahajan, B.M., "Inter-room Air Flow by Natural Convection Via A Doorway Opening," submitted 1986

Liu, S.T., "Experimental and Analytical Investigation of Solar Radiation on Interior Surfaces of a Sunspace," submitted 1986

McCabe, M.E., "Diurnal Effectiveness of Phase Change Energy Storage Cylinder" Proceedings of 1986 ASME Solar Energy Division Conference.

Fanney, A.H. and Thomas, W.C., "Simulation of the Thermal Performance of Solar Collector Arrays," published 1982.

Klein, S.A. and Fanney, A.H., "A Rating Procedure for Solar Domestic Hot Water Systems," published 1983.

Fanney, A.H., "An Experimental Technique for Testing Thermosyphon Solar Domestic Hot Water Systems," published 1984.

Fanney, A.H. and Klein, S.A., "Performance of Solar Domestic Hot Water Systems at the National Bureau of Standards - Measurements and Predictions," published 1983.

Fanney, A.H. and Thomas, W.C., "Three Experimental Techniques to Duplicate the Net Thermal Performance of an Irradiated Collector Array," published 1982.

McCabe, M.E., "Application of Transparent Enclosure Theory to Solar Energy Absorption by Cylindrical Tubes in Sunspaces," published 1985.

Thomas, W.C. and Reed, K.A., "Effect of Infrared Irradiance on Collector Thermal Performance," in NBS editorial review.

Reed, K.A., "The Sensitivity of the Optical Performance of Solar Collectors to the Spectral Irradiance Distributions of Solar Simulators," in NBS editorial review.

Reed, K.A., "The Uniformity of Simulated Solar Irradiance and Thermal Performance Testing of Flat-Plate Solar Collectors," in NBS editorial review.

Waksman, D., Thomas, W.C., "The NBS Solar Collector Reliability/Durability Test Program: Summary of Results and Recommendations for Collector Testing," Published February 1986.

Thomas, W.C., Dawson, III, A.G., Waksman, D. "Use of Integrated Day-Long Stagnation Temperature for Measuring Changes in Solar Collector Materials Properties," published May 1985.

Dawson, III, A.G., Thomas, W.C., Waksman, D., "Solar Collector Durability Evaluation by Stagnation Temperature Measurements," published August 1983.

Thomas, W.C., Dawson, III, A.G., Waksman, D., Streed, E.R., "Incident Angle Modifiers for Flat-Plate Solar Collectors: Analysis of Measurement and Calculation Procedures," published November 1982.

Streed, E.R., Waksman, D., "Uncertainty in Determining Thermal Performance of Liquid-Heating Flat-Plate Solar Collectors," published May 1981.

Papers prepared for ASME Journal of Applied Mechanics

Sansalone, M., Carino, N.J., and Hsu, N.N., "A Finite Element Study of Transient Wave Propagation in Plates," submitted 1985.

Sansalone, M., Carino, N.J., and Hsu, N.N., "A Finite Element Study of the Interaction of Transient Stress Waves with Planar Flaws," submitted 1986.

Institute for Materials Science and Engineering (IMSE)

ASME Tribology Workshop 1985

- Jointly sponsored by NBS, DoE, & ASME
- Bill Ruff (IMSE) & John Rumble (SRD)

ASME Committee Memberships:

Materials and Fabrication Fatigue

- John Smith

Code for Pressure Piping - Technical Committee on Materials and Stresses

- Harry McHenry

Standard Reference Data (SRD)
National Measurement Laboratory

ASME Committee Membership:

Research Committee on the Properties of Steam

- Dr. Howard J. White, Jr. - Secretary. This Committee serves as the U.S. National Committee to the International Association for the Properties of Steam (IAPS), for which Dr. White is the Executive Secretary. The next Committee meeting will be held at NBS on Tuesday, December 2, 1986. The Research Committee is also represented at the annual meeting of IAPS -- this meeting was held in September 1986 in Dusseldorf, W. Germany. The next meeting will be held in September 1987 in England. In its own right and through IAPS, there are extensive interactions between the activities of the Research Committee and those of the NBS Office of Standard Reference Data.

Committee on Research on Tribology

- Dr. John Rumble helped to develop plans for a tribology information system.

Center for Chemical Physics (CCP)
National Measurement Laboratory

Conferences:

Twelfth National Waste Processing Conference, June 1986

- Dr. Eugene Domalski and Dr. Kenneth Churney presented papers.

ASME Committee Memberships:

Research Committee on Industrial and Municipal Wastes

- Dr. Eugene Domalski - Finalizing an ASME publication, "Thermodynamic Data for Biomass Conversion and Waste Incinerator," with Thomas Jobe and Thomas Milne.

BIOGRAPHICAL DATA

Name:	Nathan H. Hurt, Jr. 169 Lake Terrace Drive Munroe Falls, Ohio 44262 Tel: 216-688-9718
Position:	Program Director, Research & Development The Goodyear Tire & Rubber Company 1144 E. Market Street Akron, Ohio 44316
Education:	
High School:	North Denver High School, Denver, Colorado (1939)
College:	Montana School of Mines University of Southern California University of Colorado - BS/Mech Eng. 1947 Case Western Tech - advanced technical courses Penn State - Executive Management
Business Training:	Center for Creative Leadership, Greensboro, N.C. George Washington U., Edward Deming Programs " Japanese Style Productivity and Quality"
Military Service:	USNR 1942 - 1946

Work history at Goodyear:

Positions held:

March 1986 - Present:	Program Director, Goodyear Tire & Rubber Company Research & Development, Akron, Ohio
1984-1986	President, Goodyear Atomic Corporation
1977-1984	General Manager Goodyear Atomic Corporation - Piketon, Ohio
1975-1977	Deputy General Manager Goodyear Atomic Corporation - Oak Ridge, Tn.
1972-1975	Deputy General Manager Goodyear Atomic Corporation - Piketon, Ohio
1968-1972	Manager, Plant Engineering & Maintenance Goodyear Atomic Corporation - Piketon, Ohio
1966-1968	Director, Foam Products Operations
1963-1966	Plant Manager, Logan, Ohio Plant
1962-1963	Manager, Rubber Chemicals Plant Akron, Ohio

1959-1962	Resident Engineer, Contract Administrator and Consultant on loan from GT&R to Petroleo Brasiliero for design, construction, and operation of a synthetic rubber plant. Rio de Janerio, Brasil
1956-1959	Manager, Chemical Plants Engineering Dept. Akron, Ohio
1952-1956	Superintendent, Plant Engineering Goodyear Atomic Corporation - Piketon, Ohio
1947-1952	Engineer, Corporate Engineering Staff
Registration:	Registered Professional Engineer State of Ohio
Professional Activities:	Vice President American Society of Mechanical Engineers Member - American Institute of Chemical Engineers National Society of Professional Engineers Ohio Society of Professional Engineers Tau Beta Pi Honorary Engineering Society Pi Tau Sigma Honorary Mechanical Engineering Society Atomic/Industrial Forum (Past) Institute of Nuclear Materials Management American Society of Engineering Mgmt. Member of Texas A & M Industry Advisory Committee
Current lecture topics:	Social and Political Aspects of Energy Security An Appeal for a Return to Common Sense (The impact of government regulations on innovation and technology and particularly on nuclear energy application) Management Training for Engineers Enrichment of Uranium The Portsmouth Area Uranium Enrichment Plant Management is Fun(ny) Committees, Meetings, and Conferences - Slaves or Masters of Management
Civic Activities:	Scout Leader, Past V.P., Chief Logan Council Rotary Club Director, Logan & Chillicothe,Ohio Hospital Boards, Chillicothe & Loan, Ohio Country Club Board: Chillicothe, Ohio Chamber of Commerce, Jackson, Ohio Chillicothe, Ohio Portsmouth, Ohio Pike County, Ohio
Listings:	Who's Who in engineering Who's Who in Finance & Industry Who's Who in Midwest Who's Who in Society Member of Texas A & M Industry Advisory Committee

Mr. WALGREN. Well, thank you very much on behalf of the Committee.

Let me ask, this concern of programs that are too small to be, as Dr. Good characterized a critical mass that just—there is a real concern that we have a little program, but we're kidding ourselves that something is really happening. And I can appreciate that small efforts can do great things, particularly in this area. At the same time, are you—how broad is the concern that we just are not operating on an effective size of effort in NBS? Let me ask——

Dr. GOOD. OK.

Mr. WALGREN [continuing]. All of you very briefly.

Dr. GOOD. Well, let me just give you one example from the database effort. I can give you examples from the others, but let's talk about that one quickly, because I think that everybody at the table has emphasized how important that issue really is.

That program has been going on at the Bureau now for several years, it's not new, at a very low level. And the problem that they have is that they don't have a large enough database that they can get the attention of a distributor who would take it and distribute it on a large base. The problem is that they have small databases in isolated areas, which are very good for those small areas. But the market for each of those then is that little isolated group of folks.

So, you have the problem of then attempting to disseminate that. So, they've gone with this idea of putting it up on small PCs, and that's excellent, because there will at least be some transfer of that information to people. But what is really needed is a proper total engineering database of the information which is necessary to do engineering designs, to put the materials in that are appropriate. If we had that, then the possibility of going out to a commercial data handling and distributor is very real. And they, at that point, would indeed collaborate with the Bureau, and would probably even pay to have it maintained, you know, to do the things that would have to be done to keep it up to date. Because now it's large enough—the market is large enough, and they have a way of getting at those people. But so long as we simply have these little programs, with this database in this area, and this database in another area, we'll have to peddle it like the guy with the old peddler's cart; and in a sense, that's what these small disks and so forth on a PC are, is we're peddling it like the guy on the street that peddles his groceries.

And the problem is, we're beyond that. If we look at data handling for other kinds of activities, these large databases, we have the mechanism today to distribute that. They are good commercial outfits, that if you—to have such databases would help you do it.

So, that's just the kind of example I'm talking about. In that program, Congressman, it has been going on now for about 10 or 15 years. And at this very low level of effort you're always behind. And the problem is, you can't get anybody's attention. You know what I'm saying. You can't—you're not making a big enough wave to have somebody come and say, gee, that is just marvelous, let's get behind it.

Mr. WALGREN. What's the percentage of effort that we are now making compared to what would be an adequate level?

Dr. Good. Oh, my guess is that the percentage you're probably making at the moment is maybe 10 or 15 percent of what is really required to get it up and going. And the point is, that if you really made the decision to do it—it's a priority issue, too.

I would rather see the Bureau do five or six or seven really first rate programs, and define those, and do them well, and make an impact than to do 50 programs at these kinds of levels. You know, we all have budget constraints, and we understand that.

The other point on these is that they would also turn over. For example, if you would take five years and put a really first class effort, $20 million a year into that database preparation, you will get it up to the point where then it can be maintained for a much smaller amount of money; and then you could move to the next kind of activity, okay.

Mr. Walgren. Yes.

Dr. Good. But that's the kind of management and priority setting that's tough to do, but it's the kind of thing, I think, we just must put some effort into.

Mr. Walgren. Would anyone else like to address the same question briefly?

Dr. Drew. Well, I'd like to talk to the human resource impact of that sort of thing. I think in a number of the areas that we've addressed we've noticed the problem which has to do with program and impact is also reflected in the quality of the personnel that one can attract and maintain, operating in that area in the Bureau.

It's an extremely important thing for the Bureau to have people who are at the cutting edge of their respective technologies.

They've been very fortunate having that sort of resource. What they haven't been able to do with these marginally funded programs is to be able to renew that human resource; and we're seeing people with, and essentially, irreplaceable skills that are now coming to the end of, you know, they're looking forward to retirement now, and we don't see the new people coming along. And a marginally funded program does not provide the attractiveness, the opportunities for the new people to come in.

So, there are several effects here.

Mr. Hurt. I agree completely with Dr. Good in regards to the databases, particularly databases on materials. There are several databases in this country on materials, but there's no one good single database that you can go to.

Also, I feel like that the effort on the composite materials in ceramics could be increased considerably to the benefit of the country.

Mr. Walgren. Mr. Lee.

Mr. Lee. The National Conferences of Standards Laboratories did a survey three years ago to identify measurement requirement needs not currently being met by the Bureau. We identified 118 specific areas that were not adequately being serviced. This was reduced to 79 by the Bureau. And they were planned. No funds. Nothing has happened yet about them. That's three years ago. We're updating that survey this year.

Mr. Walgren. What's the dollar value of the—of some program to address those, on that need.

Mr. LEE. We feel that it's somewhere between $13 and $15 million.

Mr. WALGREN. Mr. Boehlert.

Mr. BOEHLERT. I'd like to—Mr. Drew particularly, but others may wish to comment. What impact do you think that the user fees that we've been discussing this morning would have on the use of NBS by industry participation in a program, the use of the facilities?

Dr. DREW. Well, I can speak as a small business entrepreneur, if you will, that is—we're in the instrumentation business, I'm President of Viking Instruments, small business. We have a strong need for interaction with the Bureau. But in the small business community I think that user fee which, probably doesn't mean very much on their side, means a whole heck of a lot.

So, I think what you're going to have is a very large withdraw, if you will, from that participation from small business.

Mr. BOEHLERT. Just the——

Dr. DREW. It's not clear that—pardon?

Mr. BOEHLERT. It's just the opposite of what we want.

Dr. DREW. Exactly. So, I think it's completely counterproductive, and I can't imagine that it is of any real significance in terms of the budget impact or the Bureau's programs itself. So, I'm unalteralby opposed to that, because I don't think it is in fact a——

Mr. BOEHLERT. Anybody else care to comment?

Dr. GOOD. Yes. I would certainly like to make one comment. Those fees are mostly small by the usual standards and whatever. I would think that a good question that one should ask is, what will it cost to implement those users' fees.

My guess is that the bureaucracy being such as it is, that by the time you got the systems up to collect them, you might not have made any money. And if that's the case, I would suggest they're not very—it's not a very fruitful way to spend some of your best talent.

Mr. BOEHLERT. Thank you, Dr. Good.

Mr. Lee.

Mr. LEE. We believe that on average, the fees that NBS charges for calibration service are higher than any other standards laboratory in the world.

An example of the problems that we have with fees: Several years ago it was felt there was a need for a laboratory accreditation program that would tie in with a measurement assurance program for microwave power measurements. And the Bureau did a study to put this program together, and a cost analysis on it; and it was approximately $300,000.00. We identified seven people that immediately wanted to partake of this. And in essence, those seven companies were asked to pay that entire fee, one shot, write it off immediately; and we don't think that's a right way to do that. We think that can be amortized over a much longer period of time, and spread that around. And there's an awful lot more people that would participate as we would go forward in that. It's a very valuable thing. But not at 300 divided by seven.

Mr. BOEHLERT. Mr. Hurt, looking at page four of your testimony you said; "We were amazed to find when this year's budget was released that OMB failed to live up to their end of the deal." We're talking about CBT and CFR now. I would use very stronger words to relate to you our reaction to that. We're not going to permit it. I can make that statement categorically; and I can speak for both sides, I think, up here.

Mr. HURT. We're glad to hear that.

Mr. BOEHLERT. Dr. Good, you say in your testimony that you're not so concerned about the consolidation that might have some beneficial aspects to it, just as long as we keep at least the funding level constant. What are the pros and cons of consolidation?

Dr. GOOD. That's a difficult one for me to answer. I don't really know the details; and I don't know what kind of savings in oversight they might get. But there's always some—there's some intellectual benefit, if it's put together properly, because the interactions of the people from one of those programs into the other, in my opinion, would be very useful. But I think utilizing that as a mechanism for cutting back the strength of the program, and the breadth of the program, that's the way you—what you might be able to do is, you might be able to combine them and actually be able to do more; and then I would be very excited. But not at the idea of putting them together, simply on the basis of then reducing the overall program, which is what is going to happen under the current recommendation.

Mr. BOEHLERT. Well, I think that's exactly the objective of the combination.

Anybody else care to comment on that?

[No response.]

Mr. BOEHLERT. That's all I have, Mr. Chairman. Wait, let me take advantage of Dr. Good's presence here, if I may.

Dr. GOOD. Yes, sir.

Mr. BOEHLERT. We have to come to grips with the realities of a $2 trillion budget deficit, and I think when all is said and done we may adjust some priorities in the Administration's budget, but the trillion dollar budget, we are probably not going to up the ante by a great deal. So, priorities are something that we have to deal with.

Can you address this superconducting, supercollider in terms of the cost and priorities dealing with the existing budget level?

Dr. GOOD. First of all, let me preference my comments by saying that the comments that I will make are supported by absolutely none of the organizations that I either advise or work for.

Mr. BOEHLERT. That qualifies as expert testimony.

Ms. GOOD. Okay.

The—I have thought about that question, obviously, a great deal, as most of us have who are interested in the health of the science, and the health of technology in this country. The problem that you have is that, it is a priority issue. The difficulty, though, is that you—philosophically, I am in favor of that program. There's no question about that.

It's an area in which we have a bona fide lead in the science. We are leaders in the world in that area. The physics community has looked at it, at great lengths, and it's their feeling it really is where the next wave of physics knowledge is going to come from.

Now, the question is, then, how do you fund it? How do you work that into the other budgets?

The difficulty is that if it is a zero sum game, which—first of all, I think if you take the attack that it is a zero sum game, it will by definition be a zero sum game. And that's something, I think, the scientific community has difficulty dealing with, because if you make the argument that these are the leading edge technologies which we must, over a reasonable period of time, get into, then you have to say that there are programs that we have done that either are of lesser importance or they're programs that will not have the excitement and the new information that these new ones will have. And I think that there is simply no way not to turn over programs. I think that's really a mistake. We must turn over programs on these priorities.

So, whether we build the supercollider in—start it in 1988 or 1989, my feeling is that we should put in place a plan to handle those kinds of large expenditures, because this will not be the only such issue. Because we're getting to the place where many of the things that are really the leading edge.

For example, if I compare what it costs to do the supercollider with what it will cost to really do the kinds of space probes that we're going to want to do, when we are able to get back into that business, when we really want to probe the outer galaxies, when we really want to do that kind of thing, the costs are not that much out of line from what we're talking about with respect to the supercollider.

And I simply cannot see this country saying that we are in a zero sum game, and therefore, we're not going to play in those kinds of forefront efforts. I think if we take that attitude we've essentially pulled the shell in on us, and over time we'll not only, will we be not as good as we ought to be in the technology as was described earlier today, but we'll also be not—will not be the leaders in the science either.

So, it's a very difficult proposition. We have major budget pressures. One of the ways to do it is, it seems to me, is that the thing does not have to be done, the time scale on which one builds it can be stretched out. There's no question that that's possible, without doing bodily harm to it. In fact, in some ways that would perhaps assure us that we'll have a better facility at the end of that time, because it will be better planned, and you won't be ahead of the technology.

But to say that we simply should not do it, I think if we do that on these issues, then we will also say that we will not be the leaders in the space probes. We'll say that we will not be the people who build the next—the one coming after this is a major cyclatron which is being discussed and has already been started; and that's going to be one of the major tools in the characterization of materials. It's going to be a major issue in that. It's not an inexpensive piece of equipment; it's several billion dollars.

So, I think the Congress and the public simply have to understand that these are the kinds of things, if we want to remain a leadership position in science and technology, these are things we're going to have to figure out how to do. And how we set the priorities to do that, whether it's—we put it in the budget in '88 or we put it in the budget in '89, we've got to have some long range planning, and we've got to turn over some of the old things and do some of the new. If we don't, we will be a second rate player, both in the science and the technology.

Mr. **Walgren**. Well, let me, on behalf of the Committee, thank you all for your contribution to our process, and we look forward to talking to you about it in the future.

Thank you.

The last two witnesses, Dr. Edward Pfrang, Executive Director of the American Society of Civil Engineers, and Mr. Henry, President and Chief Executive Officer of the National Institute for Building Sciences.

Gentlemen, if you would come forward, and we appreciate your having stayed with us. Your written statements will be made part of the record, and please feel free to summarize and underscore a couple of points that we should have our attention brought to.

And let me start with Dr. Pfrang.

STATEMENTS OF DR. EDWARD O. PFRANG, EXECUTIVE DIRECTOR, AMERICAN SOCIETY OF CIVIL ENGINEERS, WASHINGTON, DC. AND RENE A. HENRY, PRESIDENT AND CHIEF EXECUTIVE OFFICER, NATIONAL INSTITUTE FOR BUILDING SCIENCES, WASHINGTON, DC

Dr. **Pfrang**. Good afternoon, Mr. Chairman and members of the committee.

I am Edward Pfrang, the Executive Director of the American Society of Civil Engineers. Today I am before you on behalf of ASCE, the American Association of Engineering Societies, the National Society of Professional Engineers, and the Society of Fire Protection Engineers. In all, I represent close to half of those engineers in practice in the United States today, well in excess of 500,000 members for these combined societies.

I want to thank you for this opportunity of testifying on the Administration's budget request for the National Bureau of Standards.

I can endorse much of the testimony of the panel that preceded me with regard to their support for the overall budget request of the National Bureau of Standards and particularly their indications with regard to the desirability of increases in that budget.

But what I will be commenting on today is specifically the Center for Building Technology and the Center for Fire Research.

In the four previous fiscal years, the Administration has zero funded both CBT and CFR, only to see this subcommittee and the Congress restore full funding. Now the only exception to that pattern was last year with the '87 budget when a deal was struck, an agreement, which we would have reluctantly have gone along with. That agreement called for a total reduction of roughly $1 million in the funding for CBT and CFR.

So if you were faced with a budget that went along with that agreement, then I would be here reluctantly supporting the continuation of that agreement.

However, that is not the case this year. The budget proposes that CBT and CFR be combined administratively, something that we're fairly neutral on, but we feel that what they're doing is, they're using that as a subterfuge to justify a very substantial decrease in the funding for these programs. The decrease that would be proposed is approximately a 45 percent reduction, and no way can we see that any administrative streamlining that might take place through reorganization could justify that sort of a decrease.

Since the agreement is off, we strongly urge that we go back to the original request, which was to restore the $1 million. The Administration has generally stated that if CBT and CFR were zeroed out, that the private sector would pick up these activities. I guess we're part of that private sector that's going to pick it up, and I can tell you that even if we wanted to, given the state of these industries in the United States, there is no way that we could carry that out, and we can see no other organization or groups of organizations, either in the private sector or at the state level, that could pick up these vitally important activities.

The work that CBT does, I think you're quite familiar with its importance, the fact that it is so critical to our trying to maintain some semblance of industrial competitiveness. Right now, the construction industry has been targeted by a number of foreign countries, particularly Japan, and we are seeing tremendous inroads within this industry. We are losing out on our share of the engineering market that we used to have overseas, because many of our consulting engineers used to be the principal consulting engineers around the world, and that has been targeted, and we are having a tough time remaining competitive there.

Not only that, but we're seeing that these same countries are now starting to bid on work, and very successfully bid on work in this country, and we're going to gradually see our construction industry replaced by a foreign construction industry, if we permit this trend to continue.

We need to have that very small amount of research that CBT and CFR were able to conduct. The level that they're currently operating under is a pitifully low level, but that at least helps us a little bit to completely—well, to cut back still further, as is proposed, would be totally disastrous.

We are very sensitive to the need, and we support the need for coming to grips with our overall budget deficits, but we feel that this is not the place at this time to make these cuts.

That concludes my remarks, Mr. Chairman. I'd be very happy to answer any questions which you might have.

Mr. WALGREN. Thank you very much.

Mr. Henry?

[The prepared statement of Dr. Edward O. Pfrang follows:]

STATEMENT OF

DR. EDWARD O. PFRANG
EXECUTIVE DIRECTOR

AMERICAN SOCIETY OF CIVIL ENGINEERS

ON BEHALF OF THE
AMERICAN ASSOCIATION OF ENGINEERING SOCIETIES
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS
SOCIETY OF FIRE PROTECTION ENGINEERS

FISCAL YEAR 1988 BUDGET FOR THE NATIONAL BUREAU OF STANDARDS

SUBMITTED TO THE
SCIENCE, RESEARCH, AND TECHNOLOGY SUBCOMMITTEE

SCIENCE, SPACE, AND TECHNOLOGY COMMITTEE

UNITED STATES HOUSE OF REPRESENTATIVES

Washington, DC
March 3, 1987

Good morning Mr. Chairman and members of the Committee, I am Edward O. Pfrang, Executive Director of the American Society of Civil Engineers (ASCE), which is headquartered in New York City. On behalf of ASCE, the American Association of Engineering Societies (AAES), the National Society of Professional Engineers (NSPE), and the Society of Fire Protection Engineers (SFPE) representing over a half-million engineers, I thank you for the opportunity to testify on the Administration's budget request for the National Bureau of Standards (NBS).

The Administration's fiscal year 1988 budget proposal calls for merging the Center for Building Technology (CBT) and the Center for Fire Research (CFR) and drastically cutting available funds for these unique and important programs. The Administration proposes to reduce NBS building research and fire research to $5 million base funding in fiscal 1988, down 50% from $10 million in fiscal 1986.

It was less than one year ago, Mr. Chairman, that Congress agreed to reduced funding for CBT and CFR at the level of $9 million in fiscal 1987 in return for the Administation's agreement not to propose further funding cuts for building and fire research. Release of the Administration's budget indicates that this agreement has been broken, a development that ASCE, and the other organizations represented here today, view with great concern.

As in previous fiscal years, when the Administration proposed outright termination of CBT and CFR, the rationalization for merging and cutting these research programs is that the resulting void will be filled by the private sector or state and local government. This rationalization, which this committee and the Congress have rightly rejected in recent years, belies the numerous statements filed on behalf of a variety of organizations that stressed the valuable role performed by the Centers for Building Technology and Fire Research. The continued budget assault on CBT and CFR is, indeed, perplexing if not alarming, particularly in light of the Administration's expressed commitment to improving U.S. economic competitiveness and technological development and excellence. Foreign competitors continue to strengthen their position in construction through increasing research and development. NBS building and fire research improves the usefulness, safety and economy of buildings and enhances the international competitiveness of U.S. construction services and products.

Mr. Chairman, the professional societies I represent today want Congress to know that we support, without equivocation, full funding for CBT and CFR. The specialized laboratory facilities and expert professional staffs of the Center for Building Technology and Center for Fire Research are essential public resources that should be preserved, and not destroyed.

CENTER FOR BUILDING TECHNOLOGY

The Center for Building Technology is the national building research laboratory. It performs field, laboratory and analytical research to develop measurement techniques and to evaluate the performance of construction materials, components, and systems. The program includes substantial efforts in advanced computation and automation, structural engineering, earthquake hazard reduction, building physics, materials and equipment. Engineers need sound technical information to make responsible and cost-effective decisions in the building process.

CBT is the only research program that integrates complex technical issues affecting the vast building industry. Despite the fact that it amounts to about 10% of the GNP, and that almost two-thirds of the nation's wealth is invested in constructed facilities, the building industry is quite fragmented. Because of the industry's size and diversity, it is difficult to imagine any institution in the private sector or at the state level duplicating CBT's efforts or adequately distributing the findings on its own. This interdisciplinary laboratory also integrates complex technical issues in a way that more narrowly-focused proprietary research and development cannot.

Some of the unique and valuable aspects of the CBT are:

- Unique and comprehensive facilities such as a tri-directional structural test laboratory, 12-million-pound testing machine, environmental chambers, guarded-hot-plate and calibrate hot-box, plumbing tower, anechoic and reverberation chambers;
- An integrated, nonproprietary program for removing technological market barriers to the construction industry as well as reducing unnecessary or ineffective building regulations without compromising essential levels of safety. This is the major technical information source for the development of voluntary standards by groups such as ASCE;
- A quality assurance program for 650 public and private laboratories used by designers, owners, builders and state and local governments responsible for building and transportation.

CBT also provides the authoratative laboratory support for federal agencies that need assistance in developing criteria for the design, construction and maintenance of their facilities. Although we cannot offer solid statistical evidence, the technical support from the CBT provides the federal government with significant savings in the lifecycle costs in the operation and maintenance of its buildings.

The following case illustrates the vital role CBT provides to the building industry. On January 1, 1985, the management responsibility for the ANSI (American National Standards Institute) A58-1984 Standard, "Minimum Design Loads for Buildings and Other Structures," was transferred from CBT to ASCE. This standard is the only nationally recognized voluntary concensus on structural loads in the United States. It is widely used as a resource document by other codes and standards groups, regulatory authorities and engineers confronted with unusual design situations not covered by building codes.

Though management of the Standard will now reside with ASCE, and thereby with the private sector, CBT will continue to be the principal source of new technology to update ANSI A58. CBT programs such as Wind Loads on Buildings, Seismic Design Criteria, Floor Loads, Fire Loads, Reliability Analysis and Design Analysis have been and will continue to provide invaluable input for the standard. Without future technological support by CBT programs, the future of this important standard will be seriously compromised.

During the past decade, inflation and budget cuts have significantly reduced support for NBS building research. Moreover, Federal agencies with building-related programs have curtailed funding for research. NBS has also received new responsibilities such as earthquake hazards reduction and structural failures investigations, but without the benefit of additional resources. Despite budget difficulties, CBT has commenced research in areas critical to U.S. competitiveness in construction, including advanced computation and automation in building design, construction and use; automatic controls on building service systems; and indoor air quality. Unfortunately, research has been eliminated in other areas including foundations and geotechnical engineering.

CBT's recent accomplishments are many, they include: the first full-scale laboratory test in the U.S. of a bridge column subjected to simulated earthquake; the 1985 Mexico earthquake investigation; and a standard approved by ASTM for estimating the inplace strength of concrete. During the current year CBT will develop probabilistic design criteria for glu-laminated and engineering heavy timber structural elements taking into account load duration and damage accumulation. The criteria will be included in a pre-standardization document of ASCE.

Maintaining the technical quality of the U.S. construction industry is vital to the quality of life, public safety, and U.S. economic competitiveness. The U.S. can ill afford to lose domestic and international markets for U.S. construction services and products to foreign competitors with strong R & D bases. As the principal source of non-proprietary R & D for the construction industry, it is imperative that we sustain the NBS building research program.

CENTER FOR FIRE RESEARCH

The Center for Fire Research also contributes to public safety in a way that no privately-funded research effort could. CFR explores the processes that initiate, propogate and suppress real fires. As a result, realistic material test methods of fire control and extinguishment can be developed. Like CBT, CFR does not promulgate or enforce standards or regulations. Instead, it provides technical support to voluntary standards and model codes groups, engineers, the building industry and fire organizations.

CFR is the world leader in the development of mathematical fire models and computer simulation. Given the disturbingly high fire death rate in the U.S., the importance of CFR programs cannot be overemphasized. Despite an improved U.S. fire loss record over the last decade, each year U.S. fires result in over 6,000 deaths, 200,000 injuries, and $7.5. billion in property losses.

A drastic reduction in CFR funding, as proposed in the Administration's budget, would seriously impair a number of salient CFR activities including:

- technical assistance to over 100 standard-writing and code committee;
- the fire research grants program at U.S. universities;
- information to the building industry on fire safety technology;
- research on combustion product toxicity, which accounts for 80% of all fire deaths;
- research directed at reducing fire protection costs through improved codes and standards and less redundancy in fire protection
- research into new products, materials, and practices that often introduce new hazards.

If the specter of eliminating lifesaving opportunities does not deter efforts to curtail the CFR, the cost-saving implications should persuade a budget-conscious government to reconsider the proposal. Fire-safe building design techniques can save money for all sectors of our society. Through use and implementation of scientifically-based models and evaluation tools, CFR is attempting, by the end of the century, to reduce fire deaths by 3,000 per year and fire protection costs by $15 billion per year. Mr. Chairman, the budget request for CFR is at best, harmful to the economic interests of the American people, and at worst, life-threatening.

NBS officials can better discuss CFR's recent accomplishments, than I, but several activities are noteworthy: the Fire Simulation Laboratory, Computer Programs for Fire Engineers, Fire and Smoke Hazard Assessment, Gas and Oil Well Blowout Fires, and Dyed Salt Water Smoke Simulation.

The societies represented here today commend efforts to reduce the federal budget deficit, but we must also warn against the myopic reduction of essential programs that will not be duplicated fully by the private sector.

The services provided by the Centers for Building Technology and Fire Research are invaluable to an important sector of our economy, the building industry. On behalf of the professional societies represented here, I urge Congress to preserve these vital programs.

Mr. Chairman, this concludes my statement. Again, thank you for the opportunity to appear here today. I will be happy to answer any questions.

AMERICAN SOCIETY OF CIVIL ENGINEERS

The American Society of Civil Engineers (ASCE), founded in 1852, is the oldest national engineering society in the United States. Membership, held by 110,000 individual professional engineers, is about equally divided among engineers in private practice; engineers working for federal, state or local governments; and those employed in research and academia. The Society's major goals are to develop engineers who will improve technology and apply it to further the objectives of society as a whole, to promote the dedication and technical capability of its members and to advance the professional and economic stature of civil engineers.

AMERICAN ASSOCIATION OF ENGINEERING SOCIETIES

The American Association of Engineering Societies (AAES) is a multi-disciplinary organization dedicated to advancing the knowledge, understanding, and the practice of engineering in the public interest. Located in Washington, DC, AAES includes 13 member societies, 6 associate societies, and 3 regional societies representing over 500,000 engineers in industry, government and education.

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

The National Society of Professional Engineers (NSPE), is a professional society, representing more than 75,000 engineers of all disciplines nationwide. The members are organized into 54 state and territorial societies and 535 local chapters, and work in industry, education, private practice, construction, and government.

SOCIETY OF FIRE PROTECTION ENGINEERS

The Society of Fire Protection Engineers (SFPE) is the international technical society for engineers involved in the multifaceted field of fire protection engineering. SFPE has 3,100 members located primarily in the United States, including engineers in private practice, in industry, in government, in manufacturing and installation of fire protection equipment, as well as technical members of the fire and casualty insurance industry. Fire protection engineers largely determine fire safety for all Americans through their impact on the designs of buildings and plants, both public and private, and their contribution to setting codes and standards. To achieve cost effective, relevant and engineered fire safety requires a solid scientific, technological base.

Mr. HENRY. You have my written testimony for the record, and I will summarize that.

I am Rene Henry, President and CEO of the National Institute of Building Sciences, and we at the Institute are honored to present our issues [sic] today on an issue we feel of national importance, the appropriation for the Center for Fire Research and Building Technology.

As you know, NIBS is Congressionally mandated to help improve the building regulatory environment and to encourage the safe introduction of innovative technology into the buildilng process. We provide a bridge between the Government and the private sector of the building community. In fulfilling this role, the Institute has worked for more than ten years with the National Bureau of Standards.

The Centers for Building Technology and Fire Research carry out research in the larger public interest, rather than that of any single firm or building industry group. We believe that the proposed reductions in funds for the Centers will sacrifice research and related activities that are important to the public interest, and that will not be carried out elsewhere.

The American building industry is fragmented. Each step in the lengthy process of designing, constructing, operating, and renovating a building is dominated by small firms, highly specialized in functions related only to a small part of the overall process.

Research, principally in the public interest, however important it might be to such firms, is well beyond their resources. The large firms in the building industries tend to be materials manufacturers. Some of these can and do invest in research and development. Their interest necessarily is centered on their own products, and they must limit their research expenditures, if they are to meet competition from their smaller counterparts who don't incur R&D expenses.

The work of the Centers for Building Technology and Fire Research does not produce proprietary results. It is valuable precisely because it is made public, has wide benefits, and has been done by a credible public body. The value of the work by the Centers is measurable.

The National Association of Home Builders estimates that CBT recommendations on new plumbing standards could save about $500 for each new house built in this country, and judging by the production last year, just last year alone, it could have accounted for $900 million, which is about ten times what their budget is—I'm sorry—100 times.

The work also can be measured in terms of human life and suffering. The United States' fire loss record is among the worst in the world. More than 6000 Americans die in fires annually. The cost of fire to our nation is in excess of $30 billion a year. Results of the work at the Center for Fire Research is expected to make a possible 50 percent reduction in both the losses and costs of fires.

We at NIBS believe that cutting the appropriations for both CBT and CFR also will threaten seriously the long-range competitiveness of America's building industries. Few Americans realize the importance of the construction sector to our nation's economy. Including materials manufacturing, it is the nation's largest single industrial sector, providing jobs for 8.6 million, about 8 percent of all the jobs in this country, and generating $313 billion a year in economic activity.

Also, the Centers focus on a building's total environment, it's materials and how they work together, indoor air quality, and fire safety. This yields significant benefits.

Better understanding of the interaction of the building materials leads to more cost-effective use of building materials and higher quality structures. For example, a particular type of insulation might be found more effective or less desirable when used with brick, and another combination might increase the effectiveness of both materials.

Without the kind of research in the public interest conducted at the Centers, it might take twenty years for this fact to become evident to the American building community. Knowledge of materials interaction causes more effective design and enable American companies to compete with foreign manufacturers and builders. The development of this knowledge here, rather than abroad, keeps American industry in the forefront.

The Centers systems approach to analysis also can eliminate overdesign in buildings. Overdesign occurs when redundant safety factors are piled one upon another to compensate for lack of sufficient data and analysis.

The Centers also contribute new and effective test methods for use in changing building codes, so that safe new products can be introduced. Without the prospect of code changes, private firms lack incentive to invest in innovative materials and products.

The Centers increase American competitiveness well beyond the building industries. Americans spend nearly 80 percent of their lives in their homes and places of work. The Centers' contributions through studies in such areas as lighting and indoor air pollution increase the productivity of all Americans, not just those employed in the building sector.

Before closing, I would like to share a few highlights with you on a recent study we did of public and private construction and related R&D expenses in developed countries. The charts are in the back of the testimony that we are putting in for the record.

The major funding of this study was—or major finding—was that the United States lags far behind other Western nations in supporting research related to buildings and their construction. For example, Sweden, an aggressive competitor, spends about $600 on construction-related research and development for every $100,000 of expenditures on construction. Japan, about half that, $300 on R&D for every $100,000 on construction activity. By contrast, here in the United States, we are spending only $120 per $100,000 of expenditures on construction activity. Behind Sweden, Japan, also Denmark, the United Kingdom, the Netherlands, and New Zealand. In fact, almost every developed country in the world spends proportionately more on construction R&D than does the United States, with the exception of Australia.

With regard to government expenditures on construction research, Sweden's Council for Building Research spent about $60 million in 1980. France provided $15 million for its Scientific and Technical Center for Building. Here in the United States, we're talking about reducing a $9 million budget for these Centers by nearly 40 percent.

The private sector already is providing 73 percent of all the U.S. construction-related research and development funds in this country. The Federal Government is only providing 18 percent, and this is low, relative to the efforts of other countries, and it is low, relative to the U.S. effort in other industries. Of ten industries, construction ranks next to lowest in Federal Government research and development expenses.

Mr. Chairman, for these reasons and many others I haven't cited in the interest of time, the National Institute of Building Sciences has concluded that any proposed reduction in the appropriations for CBT and CFR would not serve the public interest.

Thank you.

[The prepared statement of Mr. Rene A. Henry follows:]

Testimony

of

Rene A. Henry, Jr.
President and Chief Executive Officer
National Institute of Building Sciences

before the

Subcommittee on Science, Research and Technology
Committee on Science, Space and Technology
U. S. House of Representatives

Tuesday, March 3, 1987

Mr. Chairman and Members of the Subcommittee, I am Rene A. Henry Jr., President and Chief Executive Officer of the National Institute of Building Sciences. We at the Institute are honored to appear before you to address an issue of national importance: the Fiscal Year 1988 appropriations for the National Bureau of Standards' Center for Building Technology and Center for Fire Research.

As you know, the National Institute of Building Sciences (NIBS) is a nonprofit institution authorized by Congress in 1974 with a mission to help improve the building regulatory environment and to encourage the introduction of innovative technology into the building process. In its Congressionally-mandated role as a bridge between the government and private-sector building community, the Institute conducts forums on important and sensitive issues involving all those concerned with the design, construction, maintenance, operation and regulation of our nation's buildings. In fulfilling its role, the Institute has succeeded in developing consensus, often where there had been little agreement previously.

At this time last year Chairman Walgren opened the hearings on the 1987 National Bureau of Standards appropriation by saying, and I quote:

> The Bureau of Standards has the potential to be at the cutting edge of technology in a number of fields and in fact is at the cutting edge of technology in a number of fields. It is a high technology laboratory with exemplary working relationships with the private sector.
>
> It is frequently viewed by all as a model of how government and industry can work together, and there is a very wide consensus in this country that if American industry is ever to be able to meet the economic competition that is orchestrated in other societies from Japan, from Korea, from Taiwan, and from Europe and the rest, that this kind of close working relationship must exist in our society.

As the current President and Chief Executive Officer of an organization that has worked closely with National Bureau of Standards for more than 10 years, I could not agree more with Chairman Walgren's assessment. The National Bureau of Standards is indeed on the cutting edge of technology in a number of fields and has an exemplary relationship with the private sector.

Today, however, I would like to focus primarily on the last point Chairman Walgren raised: Economic competition and the role of the National Bureau in helping American industry meet the challenge posed by foreign producers who also receive assistance from their governments.

I do not believe it is an exaggeration to say that our nation,s competitiveness is as essential to the public welfare of Americans as is our national defense. If I am correct in this assertion, then the Administration's proposed appropriation for the Centers for Building

Technology and Fire Research is of grave concern. At a time when the need for enhancement of these Centers has never been greater, the Administration is proposing to reduce by nearly over 40 percent this appropriation of only $9 million.

My concern might be less grave if cutting this particular appropriation was simply an issue of trying to keep our nation's contruction sector far in the forefront of competition. That is not the issue here. The issue is: Will our construction sector remain in the competition at all?

I am reminded of this nation's steel industry as it was in 1945 and as it is today. And steel is not the only example. Others include textiles, automobiles, agricultural equipment, small appliances and rubber and tire manufacturing. It is not an accident that the word competitiveness has become one of the most used words in every trade and national news magazine in the country. It is a reality that our nation's ability to compete in world markets is threatened on almost every front. I will discuss just one of these fronts--the construction sector.

I believe few Americans realize the importance of the construction sector to our economy. In nearly all industrial countries, construction put in place (excluding the value of land) is roughly 6 percent of of gross national product. Counting all sales of materials, total construction activity rises to approximately 10 to 12 percent of national product. The United States is no exception to this rule. This makes construction the largest single industrial sector, not in just the United States, but in nearly all developed countries. In the U.S. construction activity (including materials manufacturing but excluding financing and brokerage activities) accounts for employment of 8.6 million persons, or 8 percent of all jobs, and generates $313 billion of economic activity.

The importance of construction in the economies of all major developed countries is an important point. It means all major countries have a strong vested interest in materials development as well as related building technology. The extent of this interest is well-documented in NIBS' recently completed review of international statistics. We at the Institute found the results both surprising and disturbing. I would like to share a few of the highlights with the Subcommittee.

Among the noncommunist developed countries, the U.S. has the largest population (235 million people compared with second place Japan's 119 million). In addition, the U.S. has the largest total expenditures on total construction activities. Yet, the U.S. falls behind many much smaller countries in the relation of its construction research and development expenditures to the total value of its construction activity.

As shown in Chart 1, Sweden leads the world with expenditures on construction-related research and development of nearly six-tenths of one percent of the value of its total construction activity. This means that for every $100,000 of gross construction expenditures Sweden spents $600 on construction-related research and development. Japan spends about $300 on on research and development for every $100,000 of gross construction expenditures.

In contrast, the United States spends only about $120 on construction-related research for every $100,000 of gross construction expenditures. This is only about one-third of the percent spent by Japan and only one-fifth of the percent spent by Sweden.

After controlling for differences in sizes of the construction sectors in different countries, every developed country in the world for which we were able to obtain data, except Australia, invests more heavily in construction R&D than the United States. In the case of Japan, where the gross volume of construction activity is roughly two-thirds that of the United States, the actural dollars spent on construction-related R&D probably exceeds that spent in the United States by more than 50 percent. I say "probably" here because differences in definitions of industrial sectors and national income accounting across countries make precise international comparisons difficult. (Based on the data underlying Chart 1 and comparisons with other data sources, Japan may spend as little as the same dollar amount spent in the U.S. on construction-related R&D or Japan may spend nearly twice as much in absolute dollars as the U.S.)

With regard to governmental expenditures on construction-related research and development, the Swedish Council for Building Research spent about $60 million for construction R&D in 1980. In the same year (more recent data are not available), France provided $15 million to its Scientific and Technical Centre for Building.

By contrast, in the United States in 1980, the combined appropriation for the Center for Building Technology and the Center for Fire Research was $8.5 million. Seven years later in 1987, the combined budget is only $9 million. This level of funding is low when compared with Sweden which has a population of only 8.4 million (3.5 percent of the U.S. population) and a gross national product of about $100 billion compared to the more than $4,000 billion gross national product of the United States.

From the Institute's work with international statistics, it is clear that many countries are spending greater percentages on construction-related R&D than is the U.S., and many of these same countries now are seeking to make inroads into the American building materials and construction markets.

The threat of foreign competition can hardly be exaggerated, especially if the important new innovations will be coming from abroad. With regard to many traditional building materials, the U.S. has already lost its competitive edge. Steel, which is used for pipe as well as for beams and reinforcement for concrete construction, is a prime example. Others where foreign competition is making inroads are wood (the U.S. is now a net importer), cement, prefabricated components, roofing and flooring materials, and heating and cooling components.

The appearence of many foreign materials in the U.S. market is not surprising. As long as we continue to use the same building products, it is inevitable that foreign competition will hurt U.S. product manufacturers because of lower foreign wage rates. Moreover, the U.S. is the free world's most attractive construction market because it is the largest. To foreign competition, entering the U.S. market is a one step process that opens up a consumer market of more than 230 million people. Even with its variations in regulations and standards, the U.S. is a fairly homogeneous market where the same materials with the same specifications can be used in almost all localities.

By contrast, opening up a large European country such as France means gaining access to only about 50 million consumers. Moreover, unlike the United States, each of the major European countries has vastly different standards. Thus, each of these markets is a specialized one where materials must meet different specifications from each of the other markets. These factors make the incentive much greater for foreign firms to enter the U.S. market than for U.S. firms to trade outside. Foreign manufacturers also have the additional incentive of flat or declining domestic markets for their products.

With a budget of only $9 million, do the Centers for Building Technology and Fire Research make a difference and would cutting their budgets change the difference these Centers make?

We believe the answer to both of these questions is yes. The Centers do make a difference. The functions they perform are unique, nonduplicative, and would not be performed outside of government if the Centers' institutional functions were undermined through budgetary cutbacks.

The single most important function of the Centers is to perform critical basic research. The ability of the Centers to fulfill their other roles hinges directly on their ability and success in performing their basic research function. The research performed by the Centers, even within their very restrictive budgets, is broad-ranging. Areas of recent focus of the Center for Building Technology include:

- Developing a standard for estimating the in-place strength of concrete. This improved procedure will provide contractors with reliable information for removing formwork resulting in safer and more economical construction practices.

- Developing techniques for locating defects in reinforced concrete structural members such as beams and columns. The work will provide the technical basis for a test method to evaluate the integrity of existing structures. Since the remodeling, rehabilitation and reuse of existing structures is now at least as important as new construction, development of such testing techniques will promote the optimal use of our country's exisiting building stock at the least possible cost. This may prove especially important in providing lower and moderate income housing through reuse of structures.

- Developing and testing models for building data protocols that will be the basis for automated data exchange within the building industry. This is very basic research which, barring some major breakthrough, is not likely to yield practical applications in the building industry in the near future. When this work does reach the applications stage, it will primarily benefit smaller entities in the field (small engineering and architectural firms and small contractors).

- Developing a computer model for studying the distribution of indoor air contaminants within spaces and their movement from room-to-room and into and out of buildings. This model would assist in the assessment of indoor air quality within buildings by providing the basis for estimating contaminant movements and levels.

- Developing a simulation model to study certain properties of cement pastes. The quality and costs of concrete construction are largely controlled by certain of the properties under study.

- Developing a method for non-destructive detection of voids in seams of single-ply roofing membranes. These membranes have become the most widely-used type of water proofing for low-slope roofs, and seams are the most common cause of failure. The proposed method would provide a tool for use in improved quality control for seams. It would also provide a tool for manufacturers to test and improve their products.

- Developing models to study moisture accumulation within building walls which has a profound effect on their thermal insulation properties. These models would permit individual experiments to be extended to different wall geometrics and boundary conditions. They would also result in reliable data on the effect of typical levels of moisture accumulation on overall thermal reistance of the various wall systems.

These projects have several important characteristics. First, they frequently deal with the interface of materials rather than the performance of a single building component or material in isolation. Second, the focus is frequently on the development of methods for testing materials either prior to use or when they are part of an existing structure. Third, the projects are on the forefront of technological innovation. Although they may appear to be straightforward applied research, as simply described above, this is usually not the case. Some projects may not yield efficient, cost-effective applications for many years. Finally, the projects are all designed to serve the public interest rather than that of any individual manufacturer. This is true of the more long-range basic research as well as the more immediately useful projects for developing standards.

As a result of their research function and mandate to conduct research that is in the broad public interest, the Centers for Building Technology and Fire Research serve a number of other important and often unique functions in their respective fields.

Each Center is the only source of unbiased evaluation in its area. Both test more thoroughly than could be afforded in any private laboratory and have no vested interest in any particular product or manufacturer. No one else could have credibly sorted out factors leading to the collapse of the hotel in Kansas City.

Development of standards is an extensively performed function of each Center.

Dissemination is a critical function. All research findings are public and frequently highly publicized. Important findings are disseminated to every county in the United States to assist localities in revising old and developing new standards. When localities do not revise building codes in response to important changes in understanding structural requirements or fire safety, structures in the local area may be required to be overdesigned or may be underdesigned in ways that endanger occupants. These Centers are the only research centers outside of academia that have the credibility to serve this function well. However, unlike academia, the Centers have an incentive to disseminate information to local regulators. Dissemination helps justify their research programs.

Because of their unique research, position in the academic and applied research community and association with the government regulatory agencies, the Centers for Building Technology and Fire Research provide a valuable coordination function. In the absense of these Centers, there would be very little coordination of basic and applied building research. HUD, GSA, EPA OSHA and the other agencies whose regulatory responsibilities often overlap have little to gain institutionally by providing coordination, even if their limited budgets could accomodate this additional effort.

Work is also closely coordinated with the private sector through NIBS, and projects which graduate from basic to applied research may be dropped from the Centers' agendas because the applied work will be continued by the private sector.

The Centers are frequently essential to achieving concensus and balance between private sector interests and the public interest. Even with the best scientific research, standards require judgement. Is one failure in a million too many or is one failure in a billion required to assure public safety? In developing and propogating standards, the often pivotal role of the Centers is because of the thoroughness of their research and the range of their staffs' expertise.

Finally, and implicit of much of what is outlined above, the Centers represent the public interest through their selection of projects, unbaised research and their coordination and consensus building with the private sector.

In the absense of the Center for Building Technology and and the Center for Fire Research little, if any, of the research currently being undertaken by them would be done in the private sector. This is not because the research does not have scientific merit or is not of enormous social value. It is because of the structure of the industry and the nature of the research.

As indicated in a number of recent Wharton School studies on private sector investments in research and develop, there are three factors that discourage

R&D in an industry: A large number of highly competitive firms, a high degree of fragmentation within the industry, and the production of products for which there are few substitutes. These three factors very accurately describe the building industry.

The industry is dominated by a large number of highly competitive small firms. Each firm is generally responsible for only a small part of any particular project, and each performs a distinct function. There are few substitutes for architects, carpenters or brick layers. There are also very few substitutes for conventional housing and probably no substitutes for a factory or commerical structure.

The only large companies are materials manufacturers and forces within the industry discourage extensive basic research even by these firms. For example, because there are few vertically intergrated firms in the industry, no single manufacturer has a strong vested interest in the interface of the materials in a building. Thus, it is not profitable for a private company to do integrated systems research.

Systems research requires costly equipment, and no manufacturer could afford the highly specialized resources of Centers for Building Technology and Fire Research. Even if a firm could afford these resources, it is unlikely that it would undertake systems research. Such basic research cannot easily be directed toward the development of a specific product, and, at a time when domestic and foreign competition are squeezing profit margins, the research costs would outweigh any benefits that could be realized within the five-year horizon for R&D payoffs in the private building sector.

Like systems research, development of testing methodologies, one of the primary functions of CBT and CFR, is not directly related to development of a product. Moreover, to be credible, these methodologies must be made public. There is no gain here for an individual company, whose stock holders are demanding profits, not public service.

Private laboratories also will not undertake the research currently being done by the CBT and CFR. Basic research and systems analysis are too costly, and there are too few customers to make it profitable. Engineering firms, which may have a significant interest in the basic research, are generally small and could not afford to undertake the work.

The loss to basic research would be only one of the losses imposed by the proposed cuts in the appropriations for the Centers for Building Technology and Fire Research.

The Centers' research capabilities are a unique national resource which is not replacable in the private sector. Severe cutbacks or elimination of basic research programs will send a signal to universities not to produce certain kinds of specialists. Those specialists that are produced, as is now becoming the case, will work for foreign governments which hurts American competitiveness. The Centers provide long-run stability for building and fire research and assure our ability to carry out such research in the future. In specialized fields of basic scientific research balanced development of talent to keep America in the forefront requires balanced government funding.

A second, and very major loss, would be the setback to the development of standards for the building sector. This is an area where public health and safety are of utmost concern. Yet, individual private firms, whether large or small, have little to gain by undertaking very costly standards research. Independent labs are not equipped to undertake this work and could not afford to do so without public financial support.
States and local governements have a stake in the development of standards. However, they have neither the money nor the expertise to develop meaningful standards. To have standards developed entirely independently by local areas would be confusing for manufacturers as well as the building trades generally.

Budget cuts will also compromise the objectivity in testing provided through the Centers. Many private labs do credible work. However, manufacturers can and do shop around for another lab if the results from the first are not favorable. No other organization or group can afford to be as unbaised as CFR and CBT. Reducing the capabilities of these Centers reduces the degree of objectivity that can be brought to bear on many pressing issues.

We believe reducing the Center for Building Technology appropriation would result in a serious, though not easily quantifiable, loss to the competitiveness of the building industry over the longer-run.

The Centers' systems approach to analyzing a building as an integrated whole yields several significant benefits. First, better understanding of the interaction of materials is likely to lead to the better utilization of materials by combining them in more cost-effective ways. A very simple example would be using a particular insultation with a particular type of exterior wall. Some types of insulation may be less effective or even destructive if used with exterior brick, while other insulation types might increase the effectiveness of both materials.

Better knowledge in this area will lead to effective design and assure that American companies can compete in both price and quality with foreign manufacturers and foreign bidders on major projects. Development of knowledge in the U.S. rather than abroad will assure that American industry is in the forefront rather than at the other end of the competition.

Second, research on the interface of materials provides clues to private sector firms regarding where big payoffs are likely to be in applied research and materials development and where better or different materials are most needed.

A third benefit of the Center's systems approach to analysis is the elimination of over-design of buildings. A good case can be made that our buildings are over-designed. Various safety factors are added one upon another to compensate for our lack of data and tools for more knowledgeable analysis. The Centers' work is likely to help fill this void and should lead to more efficient, less costly designs and, hence, a more internationally competitive U.S. building industry.

Major breakthroughs in computerized interactive information exchange systems could also contribute greatly to the efficiency of American designers, builders and suppliers. Since most of the firms in the building sector are small, they would benefit greatly by ready computer access to efficient standardized design, lists of materials inventories and backlogs, and computer systems designed to transform local building codes into a standard format and terminology. Such information systems could increase the efficiency and lower the costs of all phases of the design and actual construction of a building. Given the highly fragmented nature of the U.S. building industry, these types of projects, which are still in the basic research stage for the building sector, have very high potential payoffs for competitiveness.

Yet another area where the Centers can contribute to increased competitiveness is in their standards work. This work stimulates the development of better products and better structural design. Even more importantly, it can facilitate the introduction of new techniques and products.

Often a major obstacle to introducing a new product is local building codes. Through timely work on developing and disseminating information and standards, the Centers can greatly facilitate the ability of producers to introduce new products. Moreover, the more effectively the Centers can do this job, the greater is the incentive of the private sector to make the neccessary investments to develop and market new products.

A final way that the work of the Centers is likely to increase competitiveness goes well beyond the building industry. Americans spend about 80 percent of their time in their homes or at work, usually in a building. To the extent that the Centers' projects improve the environment, comfort and functionality of buildings, their greatest contribution to increased competitiveness may not be in relation to the building industry at all.

We think our buildings provide good living and working environments. That assumption, however, is based more on ignorance than any real knowledge of how buildings affect people. Over the life of a commercial building, nearly 95 percent of the money spent to operate the building goes to paying the salaries of the building's occupants. What would the impact be if the design of buildings could be improved to increase worker productivity and decrease sick time? The limited research that has been performed in this area indicates that significant advances can be made.

With each cut in these Centers' appropriations, a portion of the broad public interest served by the Centers' research projects is lost. The alternatives to the Centers are: (1) the representation of the regulatory agencies who have limited constituencies and program responsibilities in only limited areas within fire and safety and building technology and (2) product liability cases brought at a point where the damage has been done and remedial action is too late.

We do not believe either of these solutions is acceptable. Americans, who spend nearly 80 percent of their time in either their place of work or their home, deserve more than spotty representation, and the courts are not institutionally appropriate to provide a solution. The court system is designed to determine damages and fault in specific cases not to represent the broad public interest through the appropriate interpretation of scientific research findings.

Although all of the above losses would be great, it is not necessary to resort unquantifiable arguments to justify the appropriation for these two National Bureau Centers.

To my knowledge, no one has carefully tracked the Centers' contributions that have led to substantial benefits to the public. However, we can be sure the figure is at least in the billions. Recently, research at the Center for Building Technology led to modifications of plumbing standards. The National Association of Home Builders estimates that the new standards will save about $500 for each new housing unit built in this country. Last year there were about 1.8 million new housing starts in the U.S., which translates into a total savings of $900 million for a single year. At the current annual appropriation level of $9 million for the Centers for Building Technology and Fire Research, this single year's savings would be sufficient to fund both Centers for the next 100 years.

The Center for Building Technology has also made other contributions which have resulted in substantial measureable benefits. About seven years ago, one of the Center's research projects led to new findings on the effectiveness of insulation. Reductions in insulation required by now have resulted in hundreds of millions of dollars in savings to American families.

The Administration proposes to merge Center for Fire Research and the Center for Building Technology into a single center called the Center for Fire and Building Safety Research. As part of this change, The Administration proposes to cut the combined budget of the two Centers by $3.9 million. This is a 43 percent budget cut and will eliminate approximately 49 staff positions.

As a result of these proposed Administration budget cuts, the Center for Building Technology will eliminate work on: the durability of roofing and protective coverings, indoor air quality and ventilation, and heat and moisture transfer through walls and roofs. This means at least three of the programs mentioned above will not be done. One of these, the indoor air quality modeling project, could have its biggest contribution in the workplace where most adult Americans spend nearly a third of their life. Last year a project to study the effect of lighting in the workplace was cancelled. No private company has taken over this work.

The Institute is especially concerned over the proposed cutbacks in the budget for the Center for Fire Research. The budget proposed by the Administration for this Center is $2.55 million. This is less than one half the 1987 budget. At this reduced funding level, the Center must restrict its efforts on issues of fire safety to the development of tools for fire and smoke toxicity hazard assessment and related test methods. Fundamental research to provide a better understanding of fire growth and material flammability will end, as will most work on suppression, smoke control, and smoke detection. The elimination of work in the Center on these basic components will severly hamper long-range progress in fire and smoke toxicity assesment.

One of the most serious losses will be in the area of fire modeling. Here there is a proposed reduction of 12 positions and nearly $700,000. This would amount to a 35 to 40 percent cut in the most critically needed and sensitive Center for Fire Research program. If anything, this area demands increased resources. This work does not focus on the fire modeling behavior of specific material but rather addresses crucial aspects of fire phenomena. These must be better understood to extend the scope and applicability of the fire models and critically needed measurement methods.

Also as a result of the cutback, most of the research on fire at U.S. universities will stop. The current grants program consists of about 30 research grants totalling $1.5-2.0 million and supports most of the advanced training of fire scientists in this country.

The U.S. fire loss record is among the worst in the world. We suffer fire deaths of more than 6000 annually, and the total cost of fire to the U.S. is over $30 billion a year. The Center for Fire Research is the national focal point for research to reduce these losses and costs. The results of the Center's research are expected to make possible at least a 50 percent reduction in both the losses and costs of fire and provide technical resolution of the troublesome smoke toxicity issue.

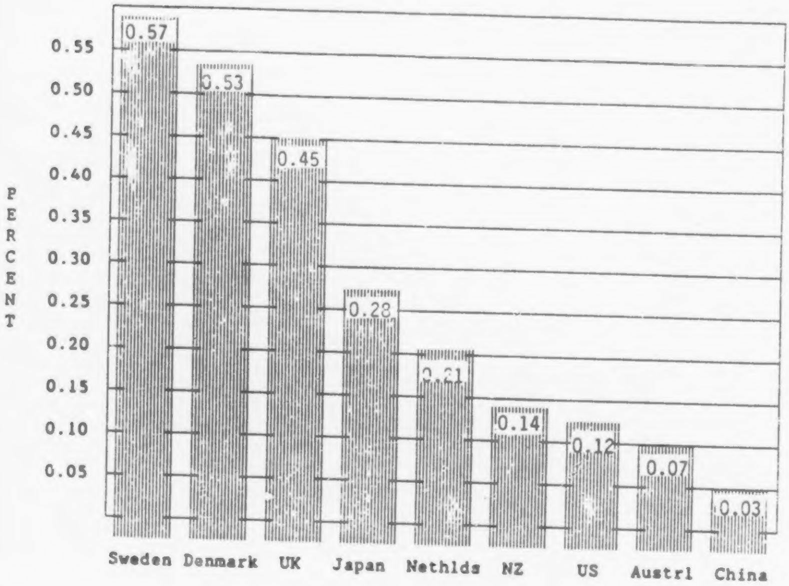
Economically, eliminating this Center would be counterproductive. It is providing the tools needed to permit growth and competition among alternative technologies for fire safety that could reduce the costs of fire safety by $7-8 billion a year within a decade. This estimate is based on full implementation of the Center's ten-year plan. Any reduction from the current level would make the Center subcritical in achieving this goal. Even the current funding level greatly reduces the potential impact of the work. The costs of fire are borne by the public. CFR research is providing world leadership in this field and creating an opportunity for U.S. competitive advantage for export of U.S. fire protection technology.

We believe there is no advantage to combining the Center for Fire Research and the Center for Building Technology. If the U.S. is to overcome the fire problem, the nation needs an organization dedicated solely to this purpose. Prior to the passage of the Fire Act, fire research at the Bureau was carried out in three independent units, only one of which was within the Center for Building Technology. The Fire Act created a separate fire research center to provide a focal point for fire research and give this program the level of management attention and autonomy needed for it to succeed with the research and effectively transfer the resulting tools to public and private sector users. That job is not quite half done. We see no significant potential for synergy between the programs or disciplines of the two Centers. There is no fire research program of such significance anywhere in the world being conducted within a building research center.

As I hope this testimony indicates, we at the Institute have considered this appropriations issue very carefully. After that careful consideration, we have concluded that any reduction in the appropriation for the Center for Building Technology or the Center for Fire Research could not serve the public interest. The public interest would be far better served by some enhancement of the appropriations for these Centers.

CHART 1

PERCENTAGE OF CONSTRUCTION R & D
TO GROSS TOTAL VOLUME OF CONSTRUCTION, 1981-82

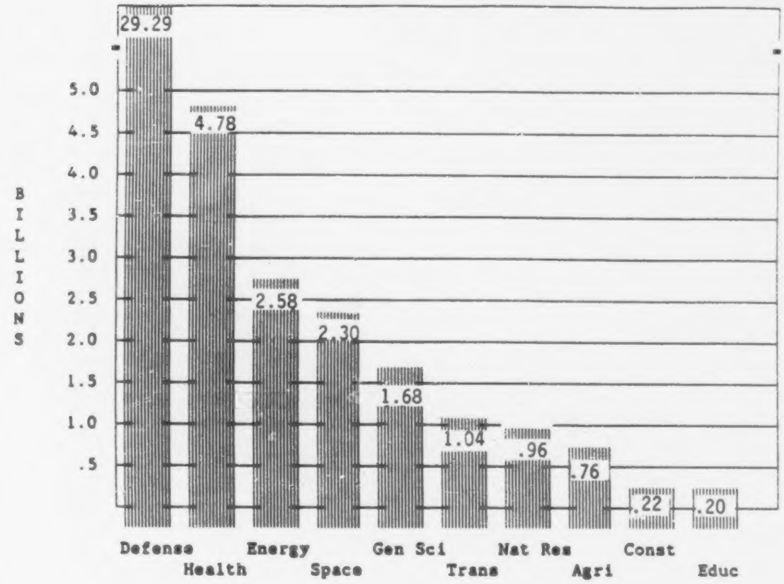


	%
SWEDEN	0.57
DENMARK	0.53
UNITED KINGDOM	0.45
JAPAN	0.28
NETHERLANDS	0.21
NEW ZEALAND	0.14
UNITED STATES	0.12
AUSTRALIA	0.07
CHINA	0.03

Source: Building Research and Development Record, Building Research and Development Advisory Board, Australian Department of Housing and Construction, Canberra, 1986, p. 19.

CHART 2

FEDERAL RESEARCH & DEVELOPMENT EXPENDITURES, 1984



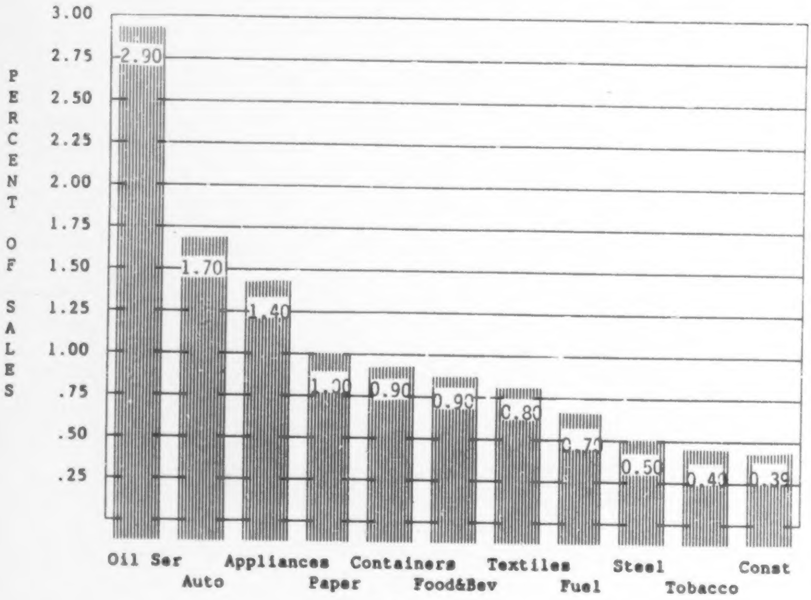
	BIL $
DEFENSE	29.29
HEALTH	4.78
ENERGY	2.58
SPACE	2.30
GENERAL SCIENCE	1.68

	BIL $
TRANSPORTATION	1.04
NATURAL RESOURCES & ENVIRONMENT	.96
AGRICULTURE	.76
CONSTRUCTION	.22
EDUCATION, TRAINING, EMPLOYMENT & SOCIAL SERVICES	.20

Source: Schwartz, J. "Federal R & D Funding by Budget Function", Washington Post, December 10, 1985, p. a-19.

CHART 3

RESEARCH & DEVELOPMENT EXPENDITURES BY U.S. INDUSTRY, 1984

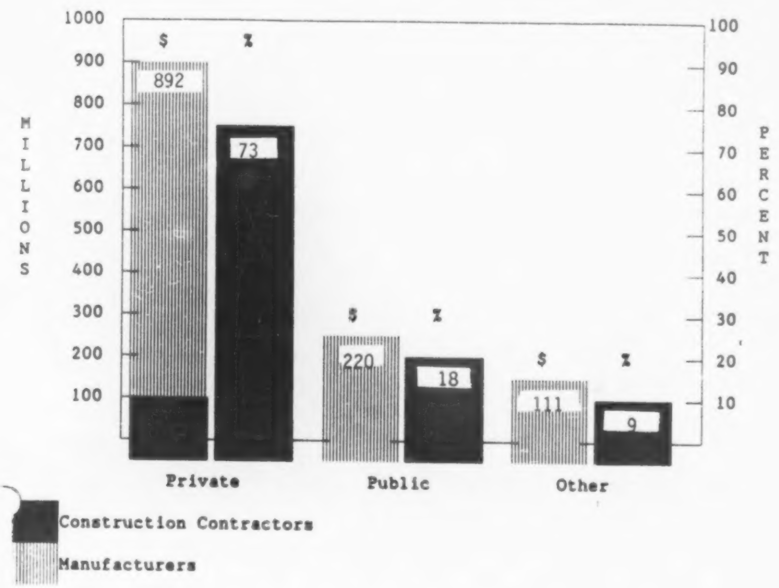


	% of Sales		% of Sales
OIL SERVICE & SUPPLY	2.90	TEXTILES	0.80
AUTOMOTIVE	1.70	FUEL	0.70
APPLIANCES	1.40	STEEL	0.50
PAPER	1.00	TOBACCO	0.40
CONTAINERS	0.90	CONSTRUCTION	0.39
FOOD & BEVERAGE	0.90		

Source: "R & D Scoreboard", Business Week, July 8, 1985, pp. 88-106.

CHART 4

U.S. CONSTRUCTION R & D EXPENDITURES, PUBLIC AND PRIVATE



	(millions)	% of Total
FEDERAL FUNDING	220	18
PRIVATE FUNDING	892	73
Construction Contractors	54	4
Manufacturers	838	69
OTHER SOURCES	111	9
TOTAL	1.223 (billions)	100

Source: Construction Productivity, National Research Council, 1986, p. 41.

National Institute of
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RENE A. HENRY JR.

President and Chief Executive Officer

Rene A. Henry Jr. is president and chief executive officer of the National Institute of Building Sciences (NIBS). He took office on January 5, 1987, the Institute's second president in its 10-year history, succeeding Gene C. Brewer.

Henry has more than 25 years of experience in management, marketing communications and financial and governmental relations. He has served as a consultant in virtually every area of the building and construction industry, including builders and developers of residential, commercial and industrial properties; architects; and building materials manufacturers and has worked with industry trade associations; government regulatory agencies; elected and appointed government policymakers at the federal, state, and local levels; and lenders and investment bankers. He has been consulted on systems technology, development, financing, and marketing both nationally and internationally.

Before joining the Institute, he was a California-based management and marketing communication consultant to companies and organizations in the building sciences and other fields. He also is well known for his contributions in the area of sports marketing.

A member of the U.S. Olympic Committee (USOC), he serves as a special advisor for the president of the USOC as well as on three committees: International Relations, Long-Range Strategic Planning Task Force, and Public Relations/Media Information. He directed the international communications campaign that led to the selection of Los Angeles as the site of the 1984 Olympic Games.

He also is a special advisor to The President's Council on Physical Fitness and Sports, a member of the Institute of Residential Marketing of the National Association of Home Builders, and a member of the Academy of Television Arts & Sciences.

He is the author of How to Profitably Buy and Sell Land, published in 1977 by John Wiley & Sons, as well as a number of reports and articles. The recipient of numerous awards in marketing and for creative excellence, he was awarded the Distinguished Citizen Award in 1980 from the Los Angeles Chapter of the Public Relations Society of America, and the Clarion Award for Human Rights from Women in Communications. He has been honored nationally and internationally for documentary and sports films he has created and produced.

Born in West Virginia, he grew up and attended high school in Norfolk, Virginia, received his A.B. degree in economics from the College of William and Mary, and did graduate study in marketing at West Virginia University, Morgantown.

His biography is listed in "Who's Who in America" and "Who's Who in Finance and Industry."

PROGRAMS AND PROJECTS SUMMARY

March 1, 1987

1. HOUSING REHABILITATION TASK FORCE

An Institute task force will evaluate the remodeling, renovation, and rehabilitation of existing housing stock -- public, private and abandoned -- as well as non-residential buildings such as warehouses and industrial buildings that could be retrofitted and made available to house low income families and the homeless. A panel will be holding hearings throughout the country later this year focusing on regulatory reforms needed to encourage greater participation from the private sector in this type of remodeling/rehabilitation activity and what must be done to reduce obstacles to make decent housing more available.

2. LAND DEVELOPMENT CRITERIA AND STANDARDS

The Institute is collecting and reviewing data on the state-of-the-art standards and criteria for land development. The emphasis is on performance criteria and flexible standards with a focus on housing affordability. Forums will be held in various regions of the country this year to gather information on the effect of local land development regulations on housing affordability including the fiscal impact on local governments and public acceptance and perceptions and user satisfaction. In Phase II of this project, recommended guidelines will be developed for voluntary adoption by local governments.

3. ASBESTOS ABATEMENT IN BUILDINGS

In July 1986, the Institute published Model Guide Specifications, Asbestos Abatement in Buildings, the nation's only authoritative, comprehensive model guide specifications for asbestos abatement in buildings. The Guide Specifications, developed through the combined efforts of NIBS' Asbestos Task Force, a support contractor to the Institute, and staff, were in response to an acknowledged need by the asbestos abatement professions and contracting sectors. The 31 sections, coordinated with the American Institute of Architects' Masterspec and organized in accordance with the Construction Specifications Institute Master Format, provide consistent and comprehensive guidance to owners, designers, environmental specialists and others confronting asbestos in buildings. More than 1,500 copies have been sold. NIBS also is developing and conducting pilot training programs in the use of the Model Guide Specifications. Five workshops will be given at the five EPA-sponsored National Asbestos Training Centers.

4. FOREIGN INFLUENCES ON THE U. S. CONSTRUCTION INDUSTRY

An Institute task force is investigating a number of areas of offshore influence on the U. S. construction industry. Technology is only one issue and involves not just manufactured housing technology in Europe and The Orient, but components, materials and building products, the entry into the market by foreign owned and headquartered building companies and the influence of foreign capital. Reports will be published on the findings.

5. FIRE HAZARDS

NIBS' program to bring sound technical judgment to fire hazards research and analysis began with Fire Hazards Conference I in August 1986. The goal is to develop rational standards as the basis for regulating fire hazards, including toxicity, of building products, materials, and contents in combustion. The Institute recently formed a working group to develop a new performance test method to measure the fire toxicity potential of building products and building contents under simulated fire conditions. Fire Hazards Conference II has been scheduled for August 11-12, the program to include a status report on the development of a performance test.

6. AUTOMATED FACILITIES ENGINEERING INFORMATION SYSTEM (AFEIS)

In January, the Institute demonstrated a prototype system for full text dissemination and automated information search and retrieval containing more than 20,000 pages of guide specifications and manuals issued by the Naval Facilities Engineering Command, the Army Corps of Engineers, and the National Aeronautics and Space Administration (NASA). Called AFEIS, for Automated Facilities Engineering Information System, the system has been developed by NIBS to reduce significant problems identified by the Navy and Army in dissemination and use of their criteria documents. Based on results to date, the Institute expects AFEIS to produce order of magnitude improvements in the ability of architects, engineers and others to quickly identify, obtain, search through and utilize criteria documents issued by a variety of organizations in and out of government. When implemented nationally in April, AFEIS will utilize optical discs known as CD-ROM (Compact Disc Read-Only-Memory) to transmit the full criteria data base to end users through a number of building community organizations.

7. STUDY OF THE MANUFACTURED HOUSING PROGRAM OF THE U. S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

A project to study the manufactured housing program of the U.S. Department of Housing and Urban Development has been started by the Institute. A volunteer group is evaluating the program and will publish its findings. The panel anticipates holding forums in several areas of the nation to gather information.

8. BUILDING SEISMIC SAFETY COUNCIL (BSSC)

With funding provided by the Federal Emergency Management Agency (FEMA), BSSC delivered NEHRP (National Earthquake Hazards Reduction Program) Recommended Provisions for the Development of Seismic Regulations for New Buildings. This was published by FEMA early in the year as part of its Earthquake Hazard Reduction Series. Other BSSC documents supplementing the Provisions also were published. The Council delivered to FEMA a Plan for Stimulating Widespread Use of the NEHRP Recommended Provisions. The Council also is developing a handbook to assist designers in application of the Provisions, due for publication early in 1987, and is initiating a program called Information Dissemination Concerning the 1985 Edition of the NEHRP Recommended Provisions. Since the most seismic-resistant building cannot function properly without essential services, BSSC, with FEMA support, is undertaking a project on mitigating seismic hazards to lifelines, which are those parts of the infrastructure that carry essential services such as power, fuel, water, and communications. This program will produce a seismic hazards abatement action plan for lifelines that FEMA and other government and private organizations can use for long-range planning.

9. CABO/NFPA DISCUSSIONS

As a result of a NIBS multi-year program, the model code groups, under CABO, and the National Fire Protection Association (NFPA) announced in 1986, a joint resolution on adoption of codes and standards. In 1983, NIBS began sponsorship of a series of meetings between CABO and the NFPA, whose fire safety criteria and whose members' responsibilities may overlap. The programs' objectives include promoting "a cooperative relationship among all code enforcement officials responsible for the administration or enforcement of building fire prevention and other related regulations."

10. BUILDING TECHNOLOGY RESEARCH AGENDA

NIBS is working with the National Bureau of Standards to identify and set priorities for building community research needs compatible with the capabilities of the Bureau's Centers for Building Technology and for Fire Research. The current effort is identifying specific research programs through a survey of building community professionals. Reports stemming from meetings will be refined through correspondence with each specialty group within the committee and balloting by the committee.

11. BUILDING PRODUCT APPROVAL

In response to concerns associated with the evaluation and approval of existing, new, and innovative building materials and products, the Institute undertook a study of the nation's building product approval process. Following approval of the report by the Project Committee, final approval under NIBS' procedures is expected in May.

12. COMMON BUILDING CODE FORMAT

In 1983, NIBS began a project working with the National Bureau of Standards and the Federal Trade Commission to study the potential of a common code format to improve the way technical provisions are organized in building codes. Although the NBS computer analysis approach was not successful in generating a rational and complete code format, NIBS' surveys of code users indicated a strong belief that a common format would be beneficial to the building community. NIBS' Board has recommended that the Consultative Council continue study of this issue to find ways of improving the consistency of building codes' organization of technical provisions and other material. A report to this effect has been delivered to, and accepted by, the Federal Trade Commission.

13. BUILDING THERMAL ENVELOPE COORDINATING COUNCIL

The Building Thermal Envelope Coordinating Council (BTECC), founded under the Institute's auspices in 1982, was engaged by the Department of Energy to prepare a third edition of the National Program Plan for the Thermal Performance of Building Envelope Systems. BTECC has appointed an editor to work directly with Research Coordinating Committees developing content for chapters addressing: Heat and Mass Transfer Measurement, Moisture, Whole Building, Air Infiltration and Ventilation, Materials, Roofing, and Fenestration.

14. WOOD PROTECTION COUNCIL

The Wood Protection Council (WPC), organized under the auspices of the Institute in 1984, soon will distribute its first publication, Indoor Sampling Guidelines for Termiticides, describing a uniform process intended to provide consistent, reliable results in termiticide sampling. As an overall mission, the Council seeks to promote guidelines for protecting wood structures, education of citizens and public officials on related issues, informational publications, appropriate provisions in codes and standards, and needed research on wood protection, and other related issues.

15. INDOOR AIR QUALITY

In 1985, NIBS published the first compilation of standards, guidelines, statutes, regulations, and other criteria related to indoor air quality. In 1987, the Institute plans to up-date the document and to add additional criteria. In May, 1986, the Institute held a workshop on radon in residential structures. The summary proceedings of the workshop and other resource information related to radon are expected to be published later this year.

Mr. **Walgren**. Your point is well taken, and we certainly agree, and I trust that we can find the room in these budgets to support this kind of effort without reductions and, in fact, with recognition of their contribution.

Mr. Boehlert?

Mr. **Boehlert**. I don't want either of our witnesses to think a lack of questions on our part represents disinterest. As a matter of fact, what it constitutes, I think, is almost total agreement with everything you've said, and there is no way in hell that we're going to accept OMB reneging on that deal, and "deal" doesn't have to be a pejorative. It was a sensible, well-thought-out, reasoned compromise. We didn't want to cut $500,000 from each of the two last year, anymore than you wanted us to. But we saw a window of opportunity, to use the great phrase that's so possible in this town today, and we went through the window. And now you see what's happening.

I'm not at all pleased with the way OMB has responded to that, and I think they just violated a trust that they had with us.

The chairman and I have talked it over at great length, and I can assure you that we are going to pursue this very vigorously, and I hope that you will be pleased with the result.

Thank you very much.

Mr. **Walgren**. Well, on behalf of the committee, thank you for your contribution to this process, and we appreciate your being a resource to us.

Thank you.

Well, that concludes the hearing, and we are convening again tomorrow morning at 9:30.

[Whereupon, at 1:10 p.m., the hearing was adjourned.]

APPENDIX

JOSEPH G. O'GRADY
President

March 13, 1987

Chairman Doug Walgren
Subcommittee on Science, Research &
Technology
Room 2319 Rayburn House Office Bldg.
Washington, DC 20515

Dear Chairman Walgren:

I am pleased to submit the attached testimony on the National Bureau of Standards Fiscal Year 1988 Budget Request for the record.

Thank you for your support. We commend you and your subcommittee for supporting the Bureau through difficult times.

Sincerely,

J G O'Grady

Joseph G. O'Grady

JGO:mmp

cc: E. Ambler
R. Kammer

ASTM, 1916 Race Street, Philadelphia, Pennsylvania 19103 / 215-299-5555 / TWX: 710-670-1037 / ASTM PHA

STATEMENT OF JOSEPH G. O'GRADY, PRESIDENT
OF
ASTM

ON THE

NATIONAL BUREAU OF STANDARDS
FY 1988 BUDGET REQUEST

SUBMITTED TO THE
SUBCOMMITTEE ON SCIENCE, RESEARCH, AND TECHNOLOGY
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

MARCH 3, 1987

I am Joseph G. O'Grady, President of ASTM.

I would like to state a few things about ASTM to lay the groundwork for why we are making this statement for the record.

ASTM, formerly known as the American Society for Testing and Materials, is the leading standards organization in the world for the development of voluntary consensus standards for materials, products, systems, and services. Its 140 standards writing committees annually publish nearly 8,000 standards to meet the needs of industry, government, academia, testing agencies, and the service sector of our economy. The ASTM committees cover a wide spectrum of subjects to include ferrous and non ferrous metals, ceramics, waste disposal, construction materials, petroleum, textiles, fire standards, medical services, biotechnology, and consumer products. Since its formation in 1898, ASTM has expanded to include some 30,000 members, of which over 3,800 are international.

Both the Bureau and ASTM were founded to help develop a firm measurement base for this country's industrial revolution at the turn of the century. Both organizations have experienced remarkable growth over the years and have developed a working relationship that has been mutually satisfactory and productive.

ASTM does not normally participate in the business of government; nor does it take a position on national policy issues. For the past several years, however, we have made one, and only one exception to this rule. We have offered our views to this Subcommittee on the importance of supporting and maintaining the life of the National Bureau of Standards because that life had been threatened by severe budget cutbacks.

The work of the National Bureau of Standards creates basic substructures upon which this nation's standards are built. ASTM produces nearly 8,000 standards; more, we believe, than any other organization in the world. The integrity of these documents is recognized in every corner of the globe. This would not be so without the participation of the almost 300 scientists and engineers of the Bureau in the work of our technical committees. This could not be so without the basic research, reference materials, and advanced measurement techniques developed by the Bureau.

We cannot stress enough the importance of this relationship.

It is almost impossible to go through a day without hearing the words "industrial competitiveness." The stunning, widespread and relentless foreign intrusion into this country's economy has created the buzz words of 1987. We hear them in the technical community as well; for the nation's industrial problems eventually become standards problems.

FOR THE RECORD, WE BELIEVE THAT THE RESEARCH ARM OF THE GOVERNMENT MUST BE FULLY SUPPORTED BY THE CONGRESS. ONLY THEN CAN IT SUPPORT US. AND ONLY THEN CAN A STRENGTHENED U.S. INDUSTRY MAKE US MORE COMPETITIVE IN THE WORLD'S MARKETS.

WE ARE HAPPY TO SEE THAT THIS YEAR THE BUREAU DOES NOT HAVE TO FACE NEAR-FISCAL-EXTINCTION.

IN ADDITION, WE WISH TO STATE OUR BELIEF THAT EVERY PROGRAM WITHIN THE BUREAU IS VITAL, THAT THE WORK OF THE BUREAU IS ONE OF THIS COUNTRY'S GREATEST ASSETS, AND THAT IT SHOULD SUFFER NO LOSS.

WE COMMEND MR. WALGREN AND THE MEMBERS OF THIS SUBCOMMITTEE FOR THEIR UNSTINTING SUPPORT OF THE BUREAU THROUGH DIFFICULT TIMES. MAY THEIR CONTINUED SUPPORT CARRY IT INTO A SECURE FUTURE.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

GOVERNMENTAL AFFAIRS OFFICE
1829 K STREET NORTHWEST, SUITE 400
WASHINGTON, D.C. 20006
(202) 466-5548

March 3, 1987

Mr. Jim Turner
Subcommittee on Science,
Research and Technology
Committee on Science, Space and Technology
2319 Rayburn House Office Building
Washington, D.C. 20515

Dear Jim:

We talked by phone on February 11th about AISC's and the fabricated structural steel industry's great interest in continued full funding and operation of the Center for Building Technology and the Center for Fire Research at the National Bureau of Standards.

You indicated that AISC would not be able to testify at the National Bureau of Standards budget authorization hearing due to time constraints. However, to insure that our views are known the attached statement for the record is submitted in 25 copies. Please insure that this statement is distributed to appropriate staff and members of the committee.

Call if you or others have any questions or I can help in any way.

Sincerely,

William Y. Epling
Vice President
Government Affairs

WYE/abw
Enclosures

STATEMENT FOR THE RECORD OF THE
AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.
REGARDING THE
FISCAL YEAR 1988 BUDGET
FOR THE
NATIONAL BUREAU OF STANDARDS

Submitted to the

House Subcommittee on Science, Research and Technology

House Committee on Science, Space and Technology

Mr. William Y. Epling
Vice President,
Government Affairs
1629 K Street, N.W.
Suite 400
Washington, D.C. 20006
(202) 466-5548

March 3, 1987

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STATEMENT FOR THE RECORD OF
THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION

The American Institute of Steel Construction (AISC) is pleased to submit this statement for the record in connection with the hearings on the Fiscal Year 1988 Budget for the National Bureau of Standards (NBS). AISC's statement will focus on the critical need for continued full funding for the Center for Building Technology and the Center for Fire Research of the NBS.

The statement provides background information on the AISC and the U.S. fabricated structural steel industry. Our statement then discusses the impact of the proposed Administration action to reduce funding for the Center for Building Technology and the Center for Fire Research on the U.S. fabricated structural steel industry and upon consumers of steel building frames and bridges.

I. General Background

A. The American Institute of Steel Construction (AISC)

AISC, headquartered in Chicago, is a unique voluntary trade association uniting the fabricators of steel framed buildings, bridges and related structures. AISC also serves the erectors, designers and educators who have professional interest in fabricated structural steel structures. AISC has three types of membership: Active, Associate, and Professional.

Active membership is open to companies that fabricate structural steel. Only firms headquartered in the U.S. are eligible. Active membership now totals 380 firms.

Associate membership is open to firms or individuals who sell a product or service related to steel construction (e.g., mill steel producers, steel deck manufacturers, bolt manufacturers, etc.). Associate membership now totals 112.

Professional membership includes firms or individuals practicing as architects or engineers, or teaching either of these professions in a recognized college or university. Professional membership now totals 2,040.

In the early years of steel-framed construction, the growth of our industry was limited by the lack of standard design principles and descriptive product terminology. Producing mills each rolled different sections or shapes and each mill had its own weight load tables and product specifications. In many cases these were inconsistent with the standards of other mills. This condition had existed for many years and was the fundamental reason the AISC was formed in 1921. The original objectives for the AISC were thus:

1. to establish a single standard construction manual recognized by building authorities and designers;
2. to establish a set of standard loading tables for all the sections rolled by the various mills; and
3. the establishment of an authority to foster the efficient use of steel that would be welcomed by the mills, engineering profession, architects, building officials and purchasers of steel.

AISC believes it has accomplished those objectives with distinction.

During recent years AISC's traditional strong emphasis on research and engineering has been expanded to encompass a wide range of educational, market research, and producer certification programs. AISC and its affiliated marketing company have a full time staff of over 50 people and operate under an annual budget of $4 million.

Through its 66 year history, AISC has been highly engineering oriented with a strong emphasis on steel research and steel design techniques. It publishes many technical publications including the "bible" of the industry - the AISC Manual of Steel Construction - which contains the well-known AISC Code of Standard Practice for Steel Buildings and Bridges and the AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings. These documents are the basis for most steel bridge and building designs and construction contracts in this country as well as in many other parts of the world.

In April 1983, AISC established a full time office in Washington, D.C. to pursue the fabricated structural steel industry's interests before the Congress, the various federal agencies and with related or allied trade associations.

B. The U.S. Fabricated Structural Steel Industry

The fabricated structural steel industry manufactures custom products for the construction industry. The principal products are steel building frames, bridges and related structures. The leading alternative construction material for these applications is reinforced concrete, which is also widely used throughout the United States. The choice between steel and concrete reflects to a large degree the particular engineering features of each structure, but price is also a major determining factor.

The structural steel fabricator plays a clearly defined and critically essential role in constructing a building or bridge. The fabricator works with the plans and specifications for the structure prepared by architects and engineers to determine the number and type of fabricated steel pieces that will be needed. Using steel shapes and plates purchased from the mill steel producers or steel service centers, the fabricator creates each of the required framing pieces. These fabricated structural steel parts are then properly grouped and transported to the construction site, where the building frame or bridge is assembled by an erecting company or the in-house erecting forces of the fabricator. Typically the fabricator is a subcontractor to the general contractor for the building or bridge.

The U.S. fabricated structural steel industry consists of approximately 1,100 firms, which are typically closely held family businesses. We estimate that the industry now employs approximately 53,000 persons, primarily ironworkers who fabricate steel in our plants. In this sense fabricate means cut, bend, drill or punch, weld or bolt pieces of steel. These ironworkers are supported by estimators, draftsmen, and management personnel.

An industry employing 53,000 persons among 1,100 firms is an industry whose firms average 48 employees. Thus, the U.S. fabricated structural steel industry is a large group of small businesses.

Steel fabricating firms are independent from the mill steel producers, which themselves generally do not engage in the fabricated structural steel business. Mill steel producers such as the Bethlehem Steel Corporation played a major role in steel fabrication until about 12 years ago but they have now largely left our business. It is widely believed that the mills withdrew from fabricating because their labor structures rendered them noncompetitive.

Bureau of Labor Statistics data show that employees of the fabricated structural steel industry earn a wage that is about two percent higher than the average industrial wage. About half of our workers are unionized.

Although the U.S. fabricated structural steel industry is separate from the mill or basic steel industry, the economies of the two are closely linked. The fabricated structural steel industry uses over five million tons of mill steel per year. As such it is a very important customer of the mill steel industry. Our total business volume is over $6 billion per year.

Approximately 55% of the cost of fabricated structural steel products is the price paid for mill steel. Thus, design economy in the amount of steel used and the unit cost of the mill steel affect our competitiveness with foreign fabricated structural steel and with concrete and other materials suitable for building and bridge construction.

The domestic fabricated structural steel industry presently is only marginally profitable. This reflects injury caused by foreign fabricators, including both actual lost contracts and suppression in the price of contracts secured by domestic firms. These effects are greatest in certain regions of the country, particularly the West Coast and the Northeast. Factors contributing to import pressure include the cost advantage enjoyed by foreign fabricators in the price of basic steel and the strength of the U.S. dollar.

Another factor affecting current profitability is the recession of 1982 which caused an overall reduction in the demand for fabricated structural steel products. Heavy construction is generally the last construction sector to rebound in a recovery but in this sustained recovery has yet to be restored. This is generally attributed to the surge in imports that are meeting demand without the normal growth in domestic production facilities. AISC estimates that total employment in the fabricated structural steel industry has fallen over 20,000 during the last six years and that we have experienced approximately 150 plant closings.

II. Issue of Funding for the Center for Building Technology and the Center for Fire Research

The Administration's budget for fiscal year 1988 proposes major reductions for the Center for Building Technology and the Center for Fire Research at the National Bureau of Standards (NBS). The American Institute of Steel construction (AISC) is seriously concerned about this proposal. The fabricated structural steel industry recognizes the centers' important contributions to building technology. We strongly urge that steps be taken to provide continuing full federal support for these two centers.

AISC is involved in long range strategic planning to move our industry forward. Technology is one of the five key objectives in our strategic plan. Activities at the NBS are critically important to us in this regard. NBS has a long history of cooperation with the steel industry. For example, NBS has been working with the steel industry for more than 80 years to improve the durability and performance of metals and alloys. In 1985 in the structural engineering area, NBS worked with AISC, the American Iron and Steel Institute (AISI) and the Metal Building Manufacturers Association (MBMA) to develop a research agenda for steel buildings.

The Center for Building Technology at NBS took the leadership role in bringing together representatives of the steel industry, federal agencies, design professionals and university researchers in a two day workshop. The particpants identified experimental and analytical research needed to advance the state-of-the-art and improve safety and economy in the design, fabrication and construction of steel buildings. They also developed a five-year plan for a coordinated research program. The workshop was sponsored by NBS, AISC, AISI, MBMA and the National Science Foundation. The workshop proceedings were published as NBS Special Publication 693.

The concept of government/industry/university cooperation to carry out a coordinated research program was fully endorsed by the NBS workshop. Such cooperation is well underway. For example, the Center for Building Technology at NBS, the AISC and the University of Arizona initiated a cooperative research project in 1985 on the bahavior of connections for steel braced frames. The project involves large-scale structural connections subjected to loads encountered in buildings subjected to wind or earthquakes.

Analytical studies at the University of Arizona, which have been going on for several years under AISC sponsorship, will serve as the basis for the cooperative project. The experimental program was developed by NBS researchers in consultation with representatives from a special AISC Task Group on Bracing for Heavy Construction and researchers from the University of Arizona. Computer studies of typical braced frame multistory buildings were conducted by the Bethlehem Steel Corporation to provide prototype values for member sizes, stress levels and connection details. These studies were used to design the test set up and select the dimensions of the test specimens to insure that the tests closely simulate the behavior of bracing members and connections in actual structures. The test specimens were fabricated in accordance with current practice and donated by the Cives Steel Company. The experimental program began at NBS in 1986. It utilizes unique experiemntal facilities available in the Center for Building Technology.

We believe this cooperative government/industry/university venture will serve as a model for future cooperative efforts in building research. It draws upon the expertise and resources of the three groups. It also illustrates the vital role the Center for Building Technology with its unique laboratory facilities and technical staff can play in improving building practices in the United States.

The AISC recognizes the need for and shares the commitment to reducing the federal budget deficit. However, we believe the services provided by the Centers for Building Technology and for Fire Research at NBS are critically important in providing advanced technology needed for the growth of the U.S. fabricated structural steel industry. We strongly urge the Congress to take steps to insure the continuation of full funding for the two centers.

Conclusion

This statement for the record documents the strong views of the American Institute of Steel Construction, the national voice of the fabricated structural steel industry, on the critical importance of continued full funding support for the Center for Building Technology and the Center for Fire Research. Only through the operation of these two centers can meaningful technological progress in steel construction continue.

Electronic Industries Association

March 4, 1987

The Honorable Doug Walgren
Chairman, Science Research & Technology Subcommittee
Committee on Science and Technology
U.S. House of Representatives
2319 Rayburn House Office Building
Washington, DC 20515

Dear Chairman Walgren:

As you begin your budget hearings for FY88, I would like to submit for the record the concern of this Association for the full and adequate funding of the optical fiber communications program of the National Bureau of Standards (NBS). Within EIA the fiber optics industry is represented by 44 corporate members within a division of the Information and Telecommunications Technologies Group. These manufacturers of fiber optic components and systems have expressed their appreciation for the valuable work in Lightwave Measurement Technology that has been accomplished at NBS and have asked me to communicate to your their concern that this very productive and high-priority measurement service receive the additional support programmed in the President's Budget.

The engineering committees of EIA's Fiber Optic Division have been following the work of NBS in addressing the measurement problems of light sources, detectors and waveguides. With the assistance of their Boulder facility we have made considerable progress in drafting standards and test procedures which guide the industry in developing this important new technology. The NBS engineers participate in committee meetings, perform needed testing at their laboratory, and observe and report on certain development work underway in corporate facilities. Their expertise, dedication and professionalism significantly enhance EIA's standards activities.

My concern, and that of our members, continues to be the research and engineering expenditure in optical fiber communications by manufacturers in other countries and the boost they are receiving from their governments. In today's wide open communications market, the supplier with superior performance and demonstrated quality will win the contract, wherever the source might be. With a world market of approximately $1.5 billion in fiber optics, that is growing about 20% per year, the awards are well worth the winning. The $500,000 requested for this program will fund high-priority measurement services essential to developing the most efficient and reliable components for lightwave systems and ensure that U.S. manufacturers can meet the expanding demand. We are addressing the telecommunications trade imbalance in other legislation and stressing the need for superior products. Towards that end, we strongly recommend approval of the NBS optical fiber communications funding plan.

Sincerely yours,

John J McDonnell Jr

John J. McDonnell, Jr.
Group Vice President
Information & Telecommunications
Technologies Group

ENTITY POSITION STATEMENT

U.S. ENGINEERING RESEARCH & DEVELOPMENT

1111 19th STREET, N.W. WASHINGTON, DC 20036-3690
(202) 785-0017

The objective of engineering research is the ultimate application of experimental and analytical results to public needs. It is not undertaken merely for the sake of knowledge, nor is it necessarily focused on an immediate product or service. Basic research must take place in engineering as much as it does in science. Neither "always comes first". The two complement each other, and both are necessary to the continued technological and industrial growth of the U.S.

Since the industrial revolution, engineering research and development (R&D) has provided fuel for industry, the engine which propels the economy of the United States. This is clearly demonstrated by reflecting upon the history of technological advances such as the steam engine, the telephone, the transistor, and the computer. These are specific examples of fundamental engineering R&D achievement in the U.S. which have established the economic stature of the country in the world community, have provided our citizens an unsurpassed quality of life, have enhanced the national security of the United States and other free nations, and have contributed to our position of international leadership. These benefits have derived significantly from a national R&D effort which has historically been perceived to provide an adequate balance between quality, quantity, and direction.

A National Policy for Technological Competitiveness

Since the late 1950's, the international economic situation has experienced major and dramatic changes. Thirty years ago, the U.S. enjoyed a secure technological position and superior industrial competitiveness in the world. Since that time, key industrial segments have been lost due to intense competition from other countries. The automobile, steel, textile, shoe and consumer electronics industries are specific examples where the dominant U.S. economic position has been lost to international competition. The semiconductor and integrated circuits industry has recently fallen into jeopardy, while many other industries are threatened with erosion of home markets and have great difficulty competing in foreign markets. Our industries must be concerned with global competitiveness if they are to survive. The fundamental role of engineering R&D in facing this international challenge must be recognized.

Approved:
United States Activities Board 11/20/86
Entity **Date**

U.S. Engineering Research & Development

Our country's critical economic position in international markets has been caused by a combination of factors, important among which has been a deemphasis of engineering R&D in the United States, and accentuation and focus on it by our competitors. Short-range goals emphasized by industry managers and executives have directed our attention away from correctly assessing the impact of engineering R&D on competitiveness. Investments in R&D and technological innovation have pronounced positive long-term effects on productivity and economic growth. Although support for research in basic science has increased somewhat, U.S. R&D investments for technology have declined, both in constant dollars and relative to our competitors.

Our nation's ability to face broad international competitiveness issues will determine our economic future and impact our national security and our way of life. A basic goal must be to ensure that the national policy of commitment to an R&D effort is adequate in quality, quantity, and direction.

To achieve this goal will require a new, positive climate for engineering R&D. This climate must increasingly encourage and support joint ventures, partnerships, and cooperation among the R&D components in our nation. These components include industry research, government laboratory research, single investigator, and cross-disciplinary research teams at the university. They include both scientific and engineering R&D.

The Federal government should assume the dominant role in developing and implementing the national policy and a change of climate for U.S. R&D. Industry has demonstrated willingness to collaborate with universities and the government because economic advantages are clear and urgent.

National policy must include a clear understanding of engineering R&D, with an awareness of what the Federal government should do, what industry should do, what the universities should do, and what the states should do in the national R&D climate. A central focal point is needed within the government which will allow a strong national commitment to R&D in technology to be articulated, advocated broadly, and implemented. The existing focus is inadequate. This policy will help ensure economic stability and long-term viability of the competitive industrial enterprise of the United States.

Problems of Implementation

The importance of investments in R&D activities is well understood and has been widely discussed. Our international competitiveness crisis is clear. There should be more direct investments throughout the U.S. R&D infrastructure, including industry, government, and the academic community. However, some changes will be required in order for industry and universities to effectively absorb and adequately cope with will-directed increases in R&D investments.

Expanding technological pressures cause industries to rely on the universities to supply highly skilled engineering manpower. Yet the universities cannot supply needed engineering talent without adequate resources. The universities must produce future faculty members as well as engineers educated for industry, and there must be a balance between the professional attractiveness of academic and industrial careers.

Universities cannot properly educated engineers if they are saddled with obsolete equipment and facilities. Technological advances in engineering, especially electrical, electronics, and computer engineering occur rapidly, often over a period as short as three years. However, amortization of equipment investments for teaching and research within the university occur over a much longer period, often a decade or more. This perpetuates obsolete university equipment.

Enrollments in engineering have increased dramatically in the last five years. This is especailly true in most electrical engineering departments. Thus, many universities are confronted by an inadequate complement of faculty members, and these faculties are often stressed by the teaching loads arising from increased enrollments, leaving little time for conducting research and interacting with industry. Development of curricula in areas important to technological competitiveness, such as manufacturing engineering, quality control, and robotics, has been neglected. This imbalance in teaching and research, when coupled with a divergence in salary scales between industry and the university, has caused some faculty members to abandon academic careers for industrial positions. It is encouraging to note that progress has been made in eliminating the imbalance between industry and university salary scales, but more effort is needed to make academic careers attractive to the brightest engineers.

All the problems discussed above tend to aggravate one another and perpetuate the problems faced by both industry and universities. These problems have been discussed in other forums and, fortunately, they are becoming more widely recognized by industry and university administrations. Unless these problems are addressed together, the situation for engineering R&D will continue to deteriorate. It must be clearly understood that joint investments by government and industry for engineering and science are required to modernize and upgrade facilities and to support the development of strong faculty with long-range academic careers.

Turning to industry, the principal problem here is that management and stockholders currently inhibit investment in long-range R&D which may fail to show profits for many years. Industry must face this problem and change its policies regarding long-range research. Research support for universities and university/industry collaboration can alleviate the problem. The role of government in encouraging and strengthening this collaboration must be pursued aggressively. A continued reluctance to face this issue is a not-very-tacit declaration of a national policy dedicated to making the United States a second-rate nation in technological competitiveness.

Recommendations

Based on the above discussions of issues of technological competitiveness and problems in implementing a national policy of commitment to strong, balanced R&D programs in science and technology, we recommend the following:

- The role of engineering R&D in national policy must be recognized by the Congress and the Executive Branch.

- A focal point within the government must be designated for advocating and implementing this policy. We reaffirm our previously stated position that a Department of Science and Technology is needed in the Federal government.

- A concerted effort by government, industry, and the universities to orient their enterprise to conform with the resulting policies must be formulated, coordinated, and launched aggressively.

- The Federal government must strengthen its direct support of innovative high risk, and long term, engineering research.

- Government and industry must increase their support for maintaining strong engineering faculties, modern facilities for research and education, and basic engineering research, and maintain a balance between individual investigators and the Engineering Research Centers on university campuses.

- The university community must increase its activities in establishing effective industry/university collaboration in engineering research. They must take concerted action to acquire expertise and develop accreditable curricula in developing areas of importance to industry.

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Gaithersburg, Maryland 20899
OFFICE OF THE DIRECTOR

MAR 26 1987

Honorable Doug Walgren
Chairman, Subcommittee on Science,
  Research and Technology
Committee on Science, Space, and Technology
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

I would like to request an extension of the deadline for submission of the report on the current and potential uses of the National Bureau of Standards (NBS) Process and Quality Control and Calibration Programs. This report is required by the NBS Authorization Act for FY 1987, and is currently due to be submitted to your Committee by April 28, 1987.

We have made excellent progress on this report, based on written material from within and outside of NBS. However, it was not possible to arrange and schedule all of the meetings which we judged necessary with corporations, other agencies and societies in time to allow analysis and compilation of the information by the April 28 deadline.

The reason for this is the limited discretionary time available to corporate and agency executives, including those of NBS. Meetings did begin at the end of January and will be completed by the end of April. Therefore, we respectfully request the granting of an extension of the due date to June 26, 1987.

I look forward to your approval of our request. I am confident that it will result in a better, more useful report, complete with recommendations as called for in the legislation.

Sincerely,

Ernest Ambler

Ernest Ambler
Director

cc: Honorable Sherwood Boehlert
    Ranking Minority Member

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General Counsel
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Republican Staff Director

March 27, 1987

Dr. Ernest Ambler, Director
National Bureau of Standards
Department of Commerce
Gaithersburg, Maryland 20899

Dear Dr. Ambler:

This is in reply to your letter of March 26, 1987, requesting an extension of time for submission of the report on the Current and Potential Uses of the NBS Process and Quality Control and Calibration Programs.

On behalf of the Subcommittee, I am writing to inform you that the deadline has been extended from April 28, 1987 to June 26, 1987 for submission of the report. We look forward to its receipt, including recommendations as called for in the legislation, at that time.

Sincerely,

Doug Walgren

DOUG WALGREN
Chairman
Subcommittee on Science,
Research and Technology

DW/cp

AAES
AMERICAN ASSOCIATION OF ENGINEERING SOCIETIES
415 Second Street, NE • Suite 200 • Washington, DC 20002 • (202) 546-2237

April 6, 1987

The Honorable Doug Walgren
Chairman
Subcommittee on Science, Research
and Technology
Committee on Science, Space, and
Technology
U.S. House of Representatives
2319 Rayburn House Office Building
Washington, DC 20515

Dear Mr. Chairman:

I am pleased to enclose the statement of the American Association of Engineering Societies on the FY 88 National Bureau of Standards appropriation.

We respectfully request that this statement be incorporated in the written record of the Subcommittee's hearings on this subject.

If additional information is needed, please contact me or Janis Fritts of the AAES staff.

Thank you.

Sincerely,

Daniel De Simone

Daniel De Simone
Executive Director

Enclosure

Engineering - Keeping America First Through Technology

AAES AMERICAN ASSOCIATION OF ENGINEERING SOCIETIES
415 SECOND STREET, NE • SUITE 200 • WASHINGTON, DC 20002 • (202) 546-2237

Statement of the

American Association of Engineering Societies

on the

National Bureau of Standards

FY 1988 Budget Request

Submitted to the

Subcommittee on Science, Research and Technology

of the

Committee on Science, Space, and Technology

U. S. House of Representatives

April 1987

ENGINEERING — KEEPING AMERICA FIRST THROUGH TECHNOLOGY

Mr. Chairman:

The American Association of Engineering Societies (AAES) is pleased to present its views on the FY 88 Budget Request for the National Bureau of Standards.

AAES is a multidisciplinary organization dedicated to advancing the knowledge, understanding, and practice of engineering in the public interest. Its members represent the mainstream of U.S. engineering--over half a million engineers in industry, government, and education. The member societies of AAES are:

American Society of Civil Engineers
American Institute of Mining, Metallurgical and Petroleum Engineers
American Society of Mechanical Engineers
Institute of Electrical & Electronic Engineers
American Society for Engineering Education
American Institute of Chemical Engineers
National Institute of Ceramic Engineers
Institute of Industrial Engineers
Society of Women Engineers
Society of Fire Protection Engineers
American Institute of Plant Engineers
American Nuclear Society
American Indian Science & Engineering Society

AAES believes that the engineering programs at the National Bureau of Standards provide essential tools that enable engineers to transform scientific knowledge into technological breakthroughs and commercial applications. These tools include new engineering data, new measurement concepts and techniques, reference materials, and the engineering practices necessary to initiate and improve standards and codes.

For many years, NBS has made major contributions to technological innovation, productivity, and enhanced public safety. However, the budget of NBS is not growing sufficiently to support many essential programs. In 1975, the appropriation for the Bureau was $60.3 million. The 1988 budget request of $138.6 million, when adjusted for inflation, represents only a slight increase in funding despite the expansion of the Bureau's measurement tasks and the imposition of additional responsibilities. In addition, the number of NBS employees has decreased from 3,800 in 1965 to about 2,900 today.

This decline in support for NBS has come at a time when valid measurements and standards are urgently needed. Additional support is essential if the U.S. is to continue to devise competitive commercial applications for new and rapidly developing technologies.

Introduction

The National Bureau of Standards has a legitimate role as the government agency that supports the nation's science and technological efforts. It is the unbiased arbiter of numerous issues relating to metrology, the science of measurements. As such, it provides a sound national system upon which the measurement of physical quantities are based. This service is vital to new product research, increased productivity, the assurance of quality, the maintenance of equity in trade, and in a multitude of space and defense applications. AAES views it as the most important component of all the Department of Commerce efforts to advance, aid, and support American industry.

Yet, despite the critical and elemental role of NBS, its basic programs have been historically underfunded. As the national interest required, the NBS has been assigned additional programs, which have also been underfunded. Although the NBS has carried out its responsibilities with a high level of scientific competence, chronic shortages of resources for both primary and secondary activities have sapped its financial and technical vitality.

AAES believes that the funding level of NBS should exceed $200 million a year and is pleased to see a step towards this goal in the $138.6 million budget that the Administration has proposed for fiscal 1988. However, of the $16.2 million increase in the budget over fiscal year 1987, $13.6 million (82 percent) is assigned to such administrative items as pay increases, retirement benefits, depreciation, and travel and communications costs. While these increases are important, the net increase in program budgets is only $2.9 million. AAES, therefore, recommends additional funding for vital NBS programs.

While the present budget deficit precludes the possibility that the NBS budget be raised to $200 million this year, we would recommend that the NBS budget be built up to this level over the course of the next three-to-five years. During this period, NBS should consult with technical and industrial organizations to set priorities and goals.

Measurement Science and Precision Measurement Standards

There has been a steady decline in the capability of the Federal government to assure the veracity and authenticity of precision measurements used in the marketplace and in defense programs. U.S. industry needs precise state-of-the-art measurements and measuring systems to provide advances in technology, to perform research, and to design better, more competitive equipment. Precisely controlled measurements are at the heart of technological advances and product competitiveness. The ability to perform these measurements gives a nation the edge in the global trade in technology. AAES is gravely concerned that work on more precise and accurate measurements in the U.S. is lagging, jeopardizing our position on international markets.

While the National Bureau of Standards has spearheaded the development of a national measurement system, its leadership has been undercut by inadequate funding and the addition of secondary functions. This has led to the delay of new products and the development of independent measurement systems which needlessly duplicate each other.

The lack of adequate resources to meet the needs of a national measurement system is particularly critical in electronics. This technology forms the largest manufacturing group in the U.S. with 2.3 million employees. The $215 billion electronics market represents about 5.5 percent of the gross national product and is growing. Export of electronics equipment is now about $40 billion. However, while exports exceeded imports by $5 billion five years ago, imports surpassed exports by an estimated $12 billion in 1986. One reason for this reversal is the failure of the NBS to develop measurement standards. In some frequency bands such as those needed for new satellite communication systems, no adequate NBS measurement standards exist. Similar deficiencies exist in fiber optics, in millimeter wave and microwave technology, and in alternating current measurement. AAES estimates that an additional $25 million a year for the next 5 to 7 years is needed to restore our national measurement standards.

The Center for Building Technology and the Center for Fire Research

The Administration's fiscal year 1988 budget proposal calls for merging the Center for Building Technology (CBT) and the Center for Fire Research (CFR) and drastically cutting available funds for these unique and important programs. The Administration proposes to reduce NBS building research and fire research to $5 million base funding in fiscal 1988, down 50 percent from $10 million in fiscal 1986.

Last year, Congress agreed to reduced funding for CBT and CFR at the level of $9 million in fiscal 1987 in return for the Administration's agreement not to propose further funding cuts for building and fire research. Release of the Administration's budget indicates that this agreement has been broken, a development that AAES views with great concern.

As in previous years when the Administration proposed outright termination of CBT and CFR, the rationale for merging and cutting these research programs is that their activities are more properly the responsibility of the private sector and state and local governments. This position, which Congress has rejected repeatedly, belies the numerous testimonials filed by a variety of organizations that stressed the unique services performed by the Centers for Building Technology and Fire Research. Furthermore, given the Administration's expressed commitment to improving U.S. economic competitiveness and technological development, the continued budget assault on CBT and CFR is perplexing and misdirected. Foreign competitors continue to strengthen their position in construction through increased research and development. NBS building and fire research improves the usefulness, safety and economy of buildings and enhances the international competitiveness of U.S. construction services and products.

We support, without equivocation, full funding for the Center for Building Technology and the Center for Fire Research. Their specialized laboratory facilities and expert professional staffs are essential public resources that should be preserved -- not destroyed.

The Center for Building Technology

The building industry plays an extraordinarily important role in the economic life of the nation. About 10% of the GNP is produced by the building industry annually and almost two-thirds of the nation's wealth is invested in constructed facilities. The Center for Building Technology--the national building research laboratory--is essential to maintaining the continued competitiveness of this sector. CBT performs field, laboratory, and analytical research to develop measurement techniques and to evaluate the performance of construction materials, components, and systems. The Center has conducted significant programs in advanced computation and automation, structural engineering, earthquake hazard reduction, and on building physics, materials, and equipment.

CBT is also important because it is the only research program capable of studying in an integrated way the complex technical issues that the building industry as a whole must confront. Because of the industry's size and diversity, it is difficult to imagine any institution in the private sector or at the state or local level capable of assuming CBT programs or distributing the findings adequately on its own. This interdisciplinary laboratory integrates complex issues in a way that more narrowly focused, proprietary research and development cannot.

The Center for Fire Research

The Center for Fire Research also contributes to public safety in a way that no privately funded research effort could. CFR explores the processes that initiate, propagate, and suppress real fires. These investigations lead to the development of realistic material test methods to control and extinguish fires. Like CBT, CFR does not promulgate and enforce standards and regulations.

Instead, it provides technical support to groups devising voluntary standards and model codes, as well as the building industry, engineers, and fire organizations.

CFR is the world leader in the development of mathematical fire models and computer simulation. Given the disturbingly high fire death rate in the U.S., the importance of CFR programs cannot be overemphasized. Despite an improved U.S. fire loss record over the last decade, each year U.S. fires result in over 6,000 deaths, 200,000 injuries, and $7.5 billion in property losses.

A drastic reduction in CFR funding would seriously hamper the development of fire control technology in the United States. If the specter of eliminating lifesaving opportunities does not deter efforts to curtail CFR programs, the cost-saving implications should persuade a budget-conscious government to reconsider the proposal. Fire-safe building design can save money for all sectors of our society. Through its ongoing research efforts, CFR hopes to reduce fire deaths by 3,500 a year and fire protection costs $15 billion a year by the end of the century. The budget request for CFR is, at best, harmful to the economic and social interests of the American people, and is, at worst, life threatening and irresponsible.

The Institute for Computer Science and Technology

Another critical operating unit of NBS is the Institute for Computer Science and Technology (ICST). ICST plays a major role in establishing computer standards and specifications and, as such, serves the Department of Commerce (DOC) goals of promoting the development and application of science and technology in U.S. industries and increasing the competitiveness of U.S. telecommunications, computer and information products, and related services. It also supports the DOC's goal of increasing the worldwide acceptance of U.S. technical standards and of improving the Federal government's cost-effective use of computer and telecommunications technology.

ICST staff serves a key role in over sixty voluntary industry standards committees, providing critical information in the development of technical specifications and in measurement and testing of draft standards. The ICST presence ensures continuity in the drafting process. For example, it is clear that the many suppliers of computer networking services and products need the unifying force of an unbiased, internationally recognized and respected third party if we are to avoid an uncontrolled, disruptive, and wasteful proliferation of incompatible computer products. This situation would be chaotic for both vendors and users, especially users like the Federal government. By developing and facilitating the adoption of key standards, ICST provides a fundamental underpinning for the computer industry that greatly stimulates innovation and enhances productivity.

The level of support for the ICST should correspond with the importance of its technical areas. These areas include software engineering, information systems engineering, data base management, computer graphics, computer security, office systems engineering, computer networking, computer architecture, and computer storage media and techniques. AAES seriously objects to ICST funding levels contemplated for 1988. The Institute was funded at $10 million in 1985, $9.6 million in 1986, and $7.5 million in 1987. Failure to fund ICST at adequate levels will lead to a major loss to U.S. industry and seriously handicap its competitive posture in domestic and international markets. We strongly support a funding level equivalent to the 1985 level of $10 million, adjusted upward for inflation. This should be followed by real increases to bring the ICST budget to at least $15 million.

Other Programs

Although increases in the proposed 1988 budget are scheduled primarily for administrative costs rather than programs, AAES supports continued funding for two important base programs. The first is the removal of hazardous polychlorinated biphenyls (PCBs) and asbestos from NBS facilities in Gaithersburg, Maryland, and Boulder, Colorado. We also support continued funding for the cold neutron research facility. AAES also believes that additional funds should be added to the NBS budget so that the alternating personnel management system for NBS scientific and engineering personnel included in the 1987 authorization can be implemented. This system will allow the director of the National Bureau of Standards to pay more competitive salaries in order to attract, motivate, and retain top-quality scientists and engineers.

In addition, AAES strongly supports the proposed $3.35 million increase for the Process Control Quality Assurance Initiative, whose goal is to assist U.S. industry in matching or exceeding the quality of foreign goods in the world marketplace. We also back the increase in funding for research on high performance composites, which play an important role in the aerospace industry. Furthermore, AAES strongly supports funding for a pilot program to compile computerized databases. These will provide engineers and scientists with ready access to the most up-to-date reference standards.

Finally, AAES is pleased to note the continuation of the postdoctoral Research Associate Program, which helps the NBS attract top-quality young engineers and scientists.

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Gaithersburg, Maryland 20899
OFFICE OF THE DIRECTOR

APR 14 1987

Honorable Doug Walgren
Chairman, Subcommittee
 on Science, Research and Technology
House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

I came across the enclosed editorial I wrote five years ago for Science magazine on U.S. cooperative efforts in research and development. My message and suggestions about how to cooperate with industry are, I think, especially relevant today.

I am sending this to you because of the intense interest in how U.S. industry can adequately compete in the world marketplace. I thought you might find this editorial interesting as a retrospective for inclusion with my written testimony in the hearing record of the March 3 hearing on authorization of appropriations for the National Bureau of Standards.

Sincerely,

Ernest Ambler

Ernest Ambler
Director

Enclosure

5 March 1982, Volume 215, Number 4537 **SCIENCE**

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Science serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

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Cooperation in R & D: Whose Responsibility?

Spurred by competitive and financial pressures, U.S. research laboratories in universities, industry, and government are searching for collaborative agreements to improve their performance. Many successful arrangements are being expanded and new ideas put forward. The National Bureau of Standards (NBS) has had considerable experience in cooperative research arrangements, and some thoughts based on our experience may be useful to others.

While some U.S. institutions are finding it possible to agree on long-term and comprehensive multimillion-dollar research ventures, we have found that cooperative efforts need not be long-term nor restricted to "big ticket" items. The big national research facilities must be shared, as we share our research reactor, synchrotron radiation source, and other facilities, but these need not be the models for all cooperative ventures. Our Research Associate Program has fostered a variety of useful cooperative research programs, many of which require little in the way of unique facilities and are narrow in scope. Each agreement has been tailored to fit the work at hand and the capabilities and goals of the participant.

Over the past decade, NBS initiated a series of research projects to improve our knowledge of the properties of liquefied natural gas (LNG) mixtures, containment materials, and measuring techniques. About half the work was funded by relatively small-scale cooperative programs with industry, particularly under the aegis of the American Gas Association. At one point we put together a 19-member consortium of natural gas users, importers, and utilities for a single project to develop a good equation of state for LNG. One of the most successful projects, backed by NBS, the American Gas Association, the Maritime Administration, and the American Bureau of Shipping, was simply to produce a well-documented, easy-to-use handbook of data for LNG users. Typically, it took 9 to 18 months to make the arrangements for a project in the LNG program. Likewise, we recently announced a major cooperative program with the American Society for Metals to collect evaluated alloy phase diagram data and make the data available through a computerized information system.

These are only two examples of the variety of our joint research ventures. About 100 industrial research associates and 40 postdoctoral fellows are working today at NBS. More than 325 professors and students are stationed in NBS laboratories each year under various guest worker arrangements. We have education agreements with 100 universities and colleges and joint research programs with the Electric Power Research Institute, the Gas Research Institute, the American Dental Association, the American Society for Testing and Materials, and others.

In carrying out cooperative research programs, one must be persistent, attentive to detail, and involve both the technical staff and managers in the initial detailed formulations and the later critiques of progress. In all our agreements there has been no substitute for the involvement of bench scientists and engineers. Laboratories wishing to collaborate in research should seek the advice of all potential participants, whether they are in industry, universities, or government. At NBS all research managers are encouraged and expected to make such interaction a way of life. That concern is manifested by daily contact with university and industry peers and users and by a variety of formal evaluation panels involving scientists and engineers selected by the National Academy of Sciences and the National Academy of Engineering. This kind of regular interaction fosters an environment that is receptive to cooperative research.

The pluralistic nature of American society presents a real variety of opportunities for cooperation, and these opportunities should be imaginatively explored. It is up to managers and researchers to be ambitious and innovative in their planning for cooperative research and to have the will to work out seemingly small but nevertheless crucial details of mutual understanding.—Ernest Ambler, *Director, National Bureau of Standards, Washington, D.C. 20234*

FLORIDA FIRE CHIEF'S ASSN.

May 11, 1987

Congressman Doug Walgren
United States House of Representatives
Washington, D. C.   20515

Dear Congressman Walgren:

As Fire Chief of the City of Bradenton, Florida and President of the Florida Fire Chief's Association, I am writing you concerning President Reagan's proposed budget cut for the activities of the Center for Fire Research in Fiscal Year 87-88, as well as the proposed combining of the Center for Fire Research and Center for Building Technology.

The Center is the only laboratory conducting objective fire research in the United States and is recognized as a world leader in that area.

If these budget cuts are administered, all research related to materials, material behavior in fire, materials tests and extinguishment will be stopped. Fire modeling of the behavior of materials will be eliminated with fire modeling reduced. Also, the fire research grants program will be reduced.

As a 27 year veteran of the fire service, I cannot begin to stress the importance of this type of research. With the rising rate of cancer and heart disease in firefighters, it behooves us to explore every facet of the dangers these dedicated men and women are exposed to on a daily basis.

I respectfully request your support in returning the full funding to the Center for Fire Research and keeping the Center and the Center for Building Technology separate entities.

Your consideration in this matter will be greatly appreciated.

Sincerely yours,

Gene Gallo

Gene Gallo
President

GG/bls

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PAUL T. O'DAY
PRESIDENT

(202) 296-6508
CABLE: FIBERASSOC

March 2, 1987

The Honorable Doug Walgren
Chairman
House Science, Research and Technology
Subcommittee
Washington, D.C. 20515

Dear Congressman Walgren:

The Man-Made Fiber Producers Association (MMFPA) would like to voice its strong support for continued funding of the Center for Fire Research (CFR), which operates under the auspices of the National Bureau of Standards (NBS).

Our Association has been an active supporter of many programs of the NBS Center, specifically in the area of combustion toxicity. Work is currently underway concerning by-products combustion and related toxicity. In addition, the CFR is currently developing computer models, utilizing nationwide data, to assess fire hazards. These models will permit realistic assessment of fire variables including ease of ignition, rate of flame spread, smoke generation and toxicity of combustion products. The models will also provide mechanisms for more cost-effective life safety systems to reduce building fires.

It is unlikely that state and local or private programs would be capable of continuing this valuable research. Even if other institutions continued these efforts, the program would be fragmented and much less effective in addressing fire hazards.

I appreciate the opportunity to offer MMFPA's strong support for continued funding of the Center for Fire Research. If I can provide further information, please do not hesitate to contact me.

Sincerely,

Paul T. O'Day

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**Illuminating Engineering Society
of North America**

**Howard Brandston
President
1983-84**

**141 West 24th Street
New York, New York 10011
212 924 4050**

JT.

February 23, 1987

Honorable Doug Walgren, Chairman
HOUSE SUBCOMMITTEE ON SCIENCE,
SPACE AND TECHNOLOGY
Suite 2321, House of Representatives
Washington, D.C. 20515

Re: Budget for National Bureau of Standards
Center for Building Technology

Dear Honorable Walgren:

The Lighting Industry is making the largest, private-sector funded research, technical transfer and education effort for the public good than it has ever made, in its entire history. Few other industries have attempted a program as ambitious as ours.

When the Illuminating Engineering Society conceived this program several years ago, we recognized that this could not be accomplished by our society alone. We created the Lighting Research and Education Fund (LREF) and the Lighting Research Institute (LRI) an independent organization to assist in this effort. It was clear to us that we would still be only one part of the group that would be supplying input on lighting.

The NBS/CBT has always been a critical partner in that group. This agency has been subject to substantial budget cuts in recent years and its very existence has been threatened. The time has come to stop those cuts. Their work is vital to our industry and we cannot do it all, nor is it appropriate for us to do it. Certain work and standards need an arms length from industry. The NBS/CBT has the position and commands the required respect to fill that role. Please do whatever is within your power to preserve it and not make further cuts, which may reduce its effectiveness.

I am currently Chairman of the Ad Hoc Committee of Lighting Research Organizations.

Members include:

Howard Brandston
Illuminating Engineering Society

John Millhone
Department of Energy

Pieter Von Herrmann
Lighting Research and Education Fund

Jack White
New York State Energy Research & Development Authority

Arnold Pickett
Electric Power Research Institute

Richard Geissler
National Electrical Manufacturers Association

As our efforts continue to grow and be worthwhile, we need a strong NBS/CBT. I ask you again for your support. We will read it as a signal that private sector efforts in providing for public benefit are recognized and appreciated.

Yours truly,

Howard Brandston, FIES, IALD
Chairman - Ad Hoc Committee on Lighting Research and Education
HB/ah

cc: All Members Ad Hoc Committee

Robert Day, President IES

American Iron and Steel Institute

1000 16th Street N.W., Washington, D.C. 20036

Milton Deaner
President
(202) 452-7146

March 3, 1987

The Honorable Douglas Walgren
Chairman
Subcommittee on Science, Research and Technology
Committee on Science, Space and Technology
U.S. House of Representatives
Washington, D. C. 20515

Dear Mr. Walgren:

I am writing to encourage continued funding of several key programs of the National Bureau of Standards to be considered at the hearing today of your Subcommittee.

The National Bureau of Standards has provided significant technical assistance to our industry in the past. Now, as severe economic pressures plague our industry, we look to NBS to help fill the research gap.

Three research areas are of particular interest to us:

. Building research - Much needs to be done to improve the efficient use of building materials and the integrity of structures. This modest program should not be further reduced.

. Fire Research - Programs in this area are specifically aimed at reducing the hazards to human life during a building fire. The present level of funding should be maintained.

. Materials Research - Advanced process control sensors are needed to improve quality and productivity. Outstanding work has been done collaboratively with NBS researchers, and this activity should be continued and strengthened.

I request that this letter be placed in the record.

Sincerely,

Milton Deaner

DCJ/mcs
cc: The Honorable Robert A. Roe
Chairman
Committee on Science, Space and Technology

J.T.

350 Sansome Street
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February 19, 1987

Honorable Douglas Walgren
Chairman, House Subcommittee on
Science, Research and Technology
Suite 2321, House of Representatives
The Capitol
Washington, D.C. 20515

Dear Congressman Walgren:

I have been perturbed recently to hear of a plan to reduce the budget of the National Bureau of Standards and its Center of Building Technology by a major amount.

It is my understanding that there are Congressional Hearings on this matter scheduled for March 3. I would hope that you and your colleagues would see your way clear to oppose any budget reduction, and would keep the same funding as in the past. If it were not for the fact that our finances are unsettled and must restrict increases, I would certainly request a significant increase over past years.

Of all of the large industrial nations, we spend by far the smallest proportion of our assets on construction research and, consequently, we are losing our trading position to other nations, both at home and abroad. In some industries, some slack could be taken up by private industry but, especially in the United States, this is impossible due to the highly fragmented organization of the construction industry.

We are in dire need of significant, impartial research in many areas of construction research, not only to protect our citizens but to regain our past leadership in the world market.

The many recent structural failures in the past few years, the major loss of life in fires (we have the highest ratios of casualties of any modern country), the threat of earthquake and the recent discoveries regarding toxic wastes, all cry out for increased, impartial research that can only be done by the National Bureau of Standards.

Thank you for any consideration that you may give to this plea.

Very truly yours,

Henry J. Degenkolb